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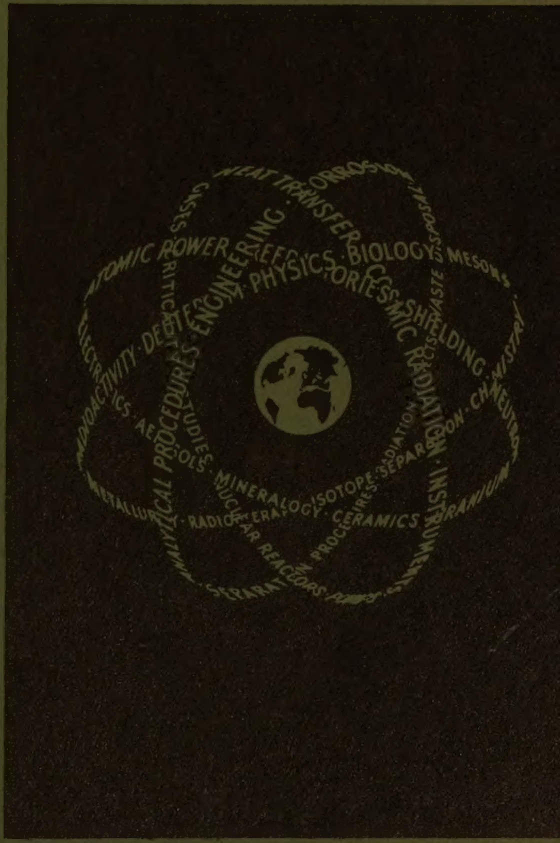

November 30, 1960

Volume 14 Number 22

Abstracts 22682–23836

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A Semimonthly Publication of the United States Atomic Energy Commission Office of Technical Information

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NSA covers (1) research reports of the United States Atomic Energy Commission and its contractors; (2) research reports of government agencies, universities, and industrial research organizations on a world-wide basis; (3) translations, patents, books, and articles appearing in technical and scientific journals.

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Abstracts are arranged according to broad subject categories as illustrated by the Contents (page iii). A new system of subject categories has been introduced in Volume 14.

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Use of funds for printing this publication has been approved by the Bureau of the Budget, July 29, 1960.

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NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 22 November 30, 1960

GENERAL AND MISCELLANEOUS

22682 CF-59-12-20
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, CHEMICAL DEVELOPMENT SECTION B MONTHLY PROGRESS REPORT [FOR] OCTOBER 1959. R. E. Blanco. Jan. 15, 1960. 47p. OTS.

The dissolution of Consolidated Edison Fuel in Darex dissolvent is being studied. Flowsheets are being developed for the dissolution of U–Mo alloy fuels containing up to 10% Mo. The dissolution of Zr alloy fuel by a modified Zirflex Process is being studied. The recovery of U and Th from graphite fuels by leaching with 15.8$\underline{M}$ HNO_3 is reported. A Mini mixer-settler run established a solvent extraction flowsheet with satisfactory U and Pu recovery for processing Nuclear Ship *Savannah* fuel by a Darex-Purex system. Modified Purex solvent extraction flowsheets were tested batch countercurrently for processing CPPD-1 and Fermi U–Mo alloy fuels. Continued exposure of Ti to various Darex-Thorex environments indicates the feasibility of employing Ti equipment under all conditions envisioned including environment containing chloride, stainless steel, and 0.04 $\underline{M}$ F^-. In Sulfex depassivation tests using 12 $\underline{M}$ H_2SO_4 in part of the cycle, Mi-o-mel rates dropped from 200 to 260 mils/mo to 60 to 140 mils/mo after eight cycles. Hastelloy C corroded at fairly constant rates of 14 to 18 mils/mo during dissolution of Zircaloy-2 in 1 $\underline{M}$ HF – 0.06 $\underline{M}$ H_2O_2. In the Hermex Process an attempt to reduce active UO_2 powder by a calcium amalgam reduction was unsatisfactory. The thermal conductivity of calcined Darex waste solids in the as-formed condition varied from 0.08 Btu/hr/ft-°F at 94°F to 2.4 at 1223°F. In the evaporation and calcination of synthetic Purex 1 WW under conditions believed to be closely simulated process chemical conditions, about 1.5% of the Ru was found in the condensate. Dowex 50W resin which had received a radiation dose of 11.9 watt-hr/dry g during the processing of more than 10,000 curies of promethium-147 was found to have a capacity of 3.67 meg/gm and a moisture content of 72% compared with original values of 4.1 and 43, respectively. Voltage measurements across the condenser bank before and after wire explosions show some promise as a parameter for describing phenomenological effects. (For preceding period see CF-59-10-113.) (W.L.H.)

22683 JPL-RS-36-3(Vol.I, Pt.2)
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
RESEARCH SUMMARY NO. 36-3, VOLUME I, PART TWO FOR THE PERIOD APRIL 1, 1960 TO JUNE 1, 1960. June 15, 1960. 53p. Contract NASW-6.

Information on instrumentation, computers, materials, propulsion techniques, gas dynamics, and physics and mathematics is presented. In instrument development, the work was aimed at improving the calibration accuracy for the small-flow electromagnetic flowmeter. The research activities in computers include numerical analysis of temperature distribution in a body subject to various boundary conditions, and development of a converter for low-frequency data analysis. Materials research on ceramics was concerned with development of a high-temperature air-atmosphere furnace for firing and for use in thermal expansion measurements. In other work, construction of a hot-pressing facility to prepare specimens for thermal conductivity measurements and operation of the test facility for high-temperature measurement of thermal conductivity in ceramics are reported. Tension testing of pyrolytic graphite which was previously heated in argon to 5200°F is reported. Data are included along with crystallographic parameters and data on x-ray structure. Data obtained in tests of silicon nitride coated graphite for nozzle inserts are also included. Brittle fracture in steel pressure vessel materials was investigated. Research on solid propellants was aimed at defining an operable area for Starfinder propellants and to find an explanation of the observed high-amplitude pressure oscillations. Research in liquid propellants included work on fuel injectors, thrust chambers, and heat transfer in propellants. In physics investigations, quantum effects, incorporation in the Boltzmann–Vlasov equation for fully ionized plasma is developed. Mathematical analyses of electron drift and kinetic energy and magnetohydrodynamic flow over solids are included. Results of a study on atom densities in mixtures of nitrogen and oxygen atoms are presented, and a theoretical mechanism for the combination of these two elements is presented. Various other aspects of the reaction of atomic oxygen with nitrogen are outlined. Activities at the 21-inch hypersonic wind tunnel, the supersonic wind tunnel, the low-density dynamics gas facility, and environmental facilities are summarized. (J.R.D.)

22684 MSAR-60-126
MSA Research Corp., Callery, Penna.
PROGRESS REPORT 59 FOR JUNE AND JULY, 1960. W. J. Posey, ed. Aug. 18, 1960. 29p. Contract NObs-77023.

Blowdown tests were conducted with varying-length orifice and varying temperature gradient across the pressurizer to determine if flashing flow occurs during rapid blowdown in coolant tubes. Solution rates of hydrogen and air in a reactor water system were determined at 200 and 500°F and 300 to 1600 psig. Tests were run on type 347 stainless steel with KOH, NaOH, LiOH, and NH_4OH to determine which are less conducive to stress corrosion and best suited for pH control of the water coolant. No cracks were observed in the specimens. Flush-out studies on dead-end pipes indicated that decontamination solution efficiency increases with an increase in flow rate but good decontamination cannot be expected. Valve decontamination using a basic $KMnO_4$-citrate process with ultrasonics removed 95% of the activity in one run with the valve completely assembled. Excellent results were obtained in an in-stream position in the flush-out loop but poor results were obtained with a valve in an off-stream position. Potential methods for the removal of contaminants from waste solutions by the use of electroplating, bacterial and amberlite resins are discussed. (For preceding period see MSAR-60-78.) (C.J.G.)

22685 NP-9206
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
RESEARCH SUMMARY NO. 36-2, VOLUME I, PART 2 FOR THE PERIOD FEBRUARY 1, 1960 TO APRIL 1, 1960.
Apr. 15, 1960. 68p. Contract NASw-6.

Improvement of venturi meters used for measurement of propellant flow is reported. A full 4-arm bridge is used on the sensing spool and increased clearances are incorporated between the spool and venturi body. The control of various recurrence systems under established criterion was investigated. The asymptotic behavior of a class of linear, first-order matrix difference equations with quadratic loss criterion is mathematically analyzed. The anelastic properties of tungsten at high temperatures are being investigated with a vacuum torsion pendulum in which the wire specimen is heated electrically. Preliminary measurements on damping are presented graphically. Fabrication and properties of MgO thermal conductivity specimens are reported. A satisfactory oxychloride bond was developed for zirconium, and data on zirconium oxide stabilizers are tabulated. The effects of processing variables on the high-temperature mechanical properties of graphite were investigated. Data on processing variables and mechanical properties at 5000°F are included. Investigation of graphite nozzle materials was continued. Preliminary tension tests were run on heat-treated specimens of 4130 and 4340 low-alloy steel supplied by the developer. Typical engineering stress-strain curves for the alloys are included. Other tests on mechanical properties of these alloys were also conducted. Stress relaxation experiments were carried out on styrene–butadiene–rubber (SBR) resin binding material at −5 to +60°C and at several strains between 50 and 525 %. Tests of ablative nozzle throat materials composed of various phenolic-filled materials are reported, and erosion data are included. The experimental performance of injector-5 of the rocket-motor-injector research program was obtained using N_2O_4 + UDMH. Additional performance and heat transfer data for the $ClF_3-N_2H_4$ system are given. Injector-element development for $N_2O_4-N_2H_4$ was concerned with an experimental optimization program. Data on performance of several injector modifications are included. An investigation of the causes for explosions in the hydrazine cooling jacket of the 6K propulsion system is described in which a model flow system equivalent to that in a 6K engine was studied. Research on thrust chambers included work on a welded-rib chamber and uncooled chambers. Measurements of heat transfer from combustion gases to the inner walls of rocket engines were continued. Additional calculations of the neutral-stability curve associated with the compressible laminar boundary layer were carried out for a Mach number of 2.2. Preliminary results on measurement of drag of spheres in low-density gas are given. These measurements are being made in the interests of determining drag on re-entry bodies. Installation of the Schlieren optical system for the hypersonic wind tunnel is reported. Physics research is reported on upper-atmosphere atomic and molecular reactions, efficiency of fission electric cells, and on theoretical studies of rotating plasmas. (For preceding period see NP-8497.) (J.R.D.)

22686 TID-85(2nd Rev., Suppl.)
Office of Technical Information Extension, AEC.
REPORT NUMBER SERIES USED BY THE OFFICE OF TECHNICAL INFORMATION IN CATALOGING REPORTS. Report Numbering System. Frances E. Stratton, comp. Aug. 1960. 26p. OTS.

A comprehensive list is presented of all research and development report number series used in cataloging reports located in the files of the Office of Technical Information Extension, AEC. An alphabetical list is included for each series, identified in each case with the agency using the series to number the reports which it issues. Also included is an alphabetical list of agencies, with a list for each agency of the codes which it has used in numbering reports. (W.L.H.)

22687 TID-4100(1st Rev., Suppl. 8)
Technical Information Service Extension, AEC.
SUPPLEMENTAL INSERT SHEETS FOR ENGINEERING MATERIALS LIST. Richard E. C. Duthie, ed. July 1960. 80p.

Descriptions of engineering equipment including computers, critical assemblies, hot laboratory equipment, instruments, metallurgical equipment and processes, nuclear radiation instruments, nuclear reactors and facilities, particle accelerators, plant design and processes (chemical), radiation source units, and shielded containers are presented. (J.R.D.)

22688 UCRL-5675
California. Univ., Livermore. Lawrence Radiation Lab. and San Francisco Operations Office, AEC.
PROCEEDINGS OF THE SECOND PLOWSHARE SYMPOSIUM, MAY 13-15, 1959, SAN FRANCISCO, CALIFORNIA. PART I. PHENOMENOLOGY OF UNDERGROUND NUCLEAR EXPLOSIONS. Plowshare Series: Report No. 2. May 15, 1959. 164p. Contract W-7405-eng-48. OTS.

The main topics covered at this symposium were: underground explosion phenomenology, excavation with nuclear explosives, power and isotope recovery studies, industrial applications, and scientific experiments. (W.L.H.)

22689 UCRL-5675(p.14-18)
California. Univ., Livermore. Lawrence Radiation Lab.
SOME BASIC DATA ON UNDERGROUND NUCLEAR EXPLOSIONS. Gerald W. Johnson.

A general description is given of an underground explosion. The containment and cratering data are given for nine underground nuclear explosions. The geological data for six explosions which were contained or nearly contained are reviewed. (W.L.H.)

22690 UCRL-5675(p.19-27)
California. Univ., Los Angeles. Inst. of Geophysics.
THE EARLY CAVITY HISTORY OF RAINIER AND COMMENTS ON ENERGY STORAGE. George C. Kennedy.

There are three major chemical environments in which underground shots can be made. The knowledge of explosions in these environments is important if they are to be used for the underground storage of heat. The behavior of these three systems, which are silicate (lava, granite, slate), limestone (Ca_2CO_3), and salt (NaCl), is grossly contrasting. The phenomenology of a shot in silicate is worked out in some detail while shots in salt and limestone are covered lightly. (W.L.H.)

22691 UCRL-5675(p.28-49)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
CLOSE-IN SHOCK TIME-OF-ARRIVAL MEASUREMENTS AND HYDRODYNAMIC YIELD. F. B. Porzel.

This paper is in two parts. Part A is primarily concerned with close-in shock time-of-arrival measurements for the determination of hydrodynamic yield, on operations Rainier and Hardtack II. Part B is primarily concerned with the theoretical concepts used in Part A, and in particular, discusses some implications of the theory for these measurements which apply to control and use of explosions, aside from the specific test operations described in Part A. (W.L.H.)

22692 UCRL-5675(p.50-8)
Sandia Corp., Albuquerque, N. Mex.
SUBSURFACE EARTH MOTION. William R. Perret.

Subsurface earth motion is the time history of transient mechanical effects produced by large contained explosions and observed within the containing medium in the region extending from just outside the explosion cavity to an adjacent free surface or to the region of essentially pure elastic reaction. The studies performed in this region provide direct knowledge of reaction of the medium to explosive energy. The instruments for observing such transient effects consists primarily of accelerometers, supplemented by several specially developed velocity gages and stress or strain gages. Programs designed to explore motion in the rock surrounding the Rainier, Tamalpais, and Evans shots are discussed. (W.L.H.)

22693 UCRL-5675(p.59-70)
Stanford Research Inst., Menlo Park, Calif.
SURFACE EFFECTS. L. M. Swift.

The close-in surface effects of a deep underground explosion are described. The first arrival is a relatively sharp pulse of upward acceleration which imparts an upward velocity to the surface formations. Under the influence of this velocity, the surface continues upward, being decelerated only by the force of gravity or a little more, so that there is an appearance of a slow upward "heave." During this upward movement, cracks tend to form in the surface, but there is little tendency toward lateral or vertical displacements across the cracks, unless a major discontinuity of the formation intersects the surface. After reaching its peak, the "hump" falls back to its original position and lands with a second shock. If venting occurs it is usually in the late stages unless the burial is classed as shallow. The final positions of points on the surface near ground zero were found lower than their original position. (W.L.H.)

22694 UCRL-5675(p.71-83)
Air Force, Washington, D. C.
SEISMIC MEASUREMENTS. Carl Romney.

Preliminary technical conclusions are presented based on the analysis of seismograms recorded at more than 40 stations at the time of the Rainier explosion and seismograms recorded at more than 90 stations at the time of the Hardtack underground nuclear explosions. (W.L.H.)

22695 UCRL-5675(p.84-105)
[California. Univ., Livermore.] Lawrence Radiation Lab.
TEMPERATURE AND RADIATION DISTRIBUTIONS IN THE RAINIER SHOT ZONE. J. L. Olsen, W. P. Bennett, and D. E. Nielsen.

In an attempt to understand the phenomenology of underground nuclear explosives and their applications to the Plowshare Program, extensive radiation and temperature measurements were made in the Rainier shot zone. In order to make the measurements, it was necessary to drill holes through the zone-of-effect using standard underground drilling techniques with modifications for remote operations and radiation control. The cores taken from these holes were used for radiochemical analyses and physical properties studies. The radiation distribution in the shot zones was determined by logging the drill holes for γ radiation using a standard Jordon RAMS unit having a range of 1 mr/hr to 1000 r/hr. Temperature distributions were measured using platinum resistance thermometers and thermistors. (W.L.H.)

22696 UCRL-5675(p.106-9)
California. Univ., Livermore. Lawrence Radiation Lab.
THE DISPOSITION OF RADIOACTIVITY. R. H. Goeckermann.

Radiochemical analyses were made on samples obtained from underground explosions of 0.07- to 19-kt yield range in tuff at the NTS during 1957 to 1958. The sampling included rock cores and assorted samples of the vented material from totally- or partially-contained explosions. The radionuclides studied included tracer activities, fission products, and induced activities of observable half-life. (W.L.H.)

22697 UCRL-5675(p.114-19)
California. Univ., Livermore. Lawrence Radiation Lab.
CAVITY FORMATION. G. T. Pelsor.

The process of cavity formation in an underground explosion is traced with a one-dimensional hydrodynamic calculation. (W.L.H.)

22698 UCRL-5675(p.120-34)
California. Univ., Livermore. Lawrence Radiation Lab.
A COMPUTER CALCULATION OF RAINIER (THE FIRST 100 MILLISECONDS). John H. Nuckolls.

The purpose of these calculations is to test and develop a capability for predicting the phenomena of underground nuclear explosions from the laws of physics and the properties of materials. A special code, UNEC (Underground Nuclear Explosions Code), was developed for the IBM-709 computer to make these calculations. They extend in time from a few microseconds to ~100 msec after the Rainier explosion, and in space to a radius of several hundred feet from the site of detonation. Results are generally in good agreement with experiment. (W.L.H.)

22699 UCRL-5675(p.135-55)
Colorado School of Mines, Golden.
SPALLING AND LARGE BLASTS. John S. Rinehart.

Large contained nuclear blasts impart forces to their immediate surroundings and these forces, becoming distributed in accordance with well known laws of physics, produce damage in areas both near and remote from the blast. Many qualities of damage manifest themselves and of these one of the most esoteric is spalling, i.e., separation of rock, frequently close to a free surface, as a consequence of preferential partitioning of the momentum of the stress wave. The elemental principles of the dynamics and mechanics of spalling in soils and rocks are discussed. These principles are then used to appreciate more fully the significance of the observations of ground movement at the Rainier Blast. (auth)

22700 UCRL-5676
California. Univ., Livermore. Lawrence Radiation Lab. and San Francisco Operations Office, AEC.
PROCEEDINGS OF THE SECOND PLOWSHARE SYMPOSIUM, MAY 13-15, 1959, SAN FRANCISCO, CALIFORNIA: PART II. EXCAVATION. Plowshare Series: Report No. 2. May 14, 1959. 97p. Contract W-7405-eng-48. OTS.

Separate abstracts have been prepared on nine papers dealing with applications of nuclear explosives for certain types of excavation projects such as harbors, canals, and large dams. It is pointed out in the Preface that a kiloton of nuclear explosive energy will excavate approximately 100,000 cubic yards of material at a cost of five dollars a yard for a kiloton project or one cent a yard for a megaton project. Present-day excavation costs run from fifty cents to several dollars a yard. (C.H.)

22701 UCRL-5676(p.5-19)
Sandia Corp., Albuquerque, N. Mex.
CRATERING WITH CHEMICAL EXPLOSIVES. M. L. Merritt, B. F. Murphey, and L. J. Vortman.

The field of cratering with chemical explosives is reviewed. Implications on cratering with nuclear explosives are discussed briefly. (C.H.)

22702 UCRL-5676(p.20-8)
California. Univ., Livermore. Lawrence Radiation Lab.
EXCAVATION WITH NUCLEAR EXPLOSIVES. Melvin A. Harrison.

It is concluded that the only way to realize economy when excavating with nuclear explosives is to blow the earth completely out of the hole and leave a crater. This is economical because it is relatively easy to put a nuclear explosive in place and the cost of nuclear explosives is low per unit of energy released. The formation of craters by past nuclear detonations is described. The difference in craters created by shallow and deeply buried shots is discussed. Problems associated with the use of nuclear explosives are reviewed. (C.H.)

22703 UCRL-5676(p.29-33)
California. Univ., Livermore. Lawrence Radiation Lab.
RADIOACTIVITY AND EARTH MOTION. A. Vay Shelton.

Hazards expected from the fall-out resulting from the use of nuclear explosions in excavation projects are discussed. A prediction is presented of the fall-out for Operation Chariot. The seismic effects of underground shots are also discussed briefly. (C.H.)

22704 UCRL-5676(p.34-41)
Sandia Corp., Albuquerque, N. Mex.
LONG DISTANCE BLAST PREDICTION PROBLEMS. J. W. Reed and H. W. Church.

Sound wave paths in the atmosphere are refracted and bent toward the ground when the wave enters a layer of higher sound velocity. Rays are turned away from the ground as the wave enters regions of lower sound velocity. Sound velocity is determined at upper levels from air temperatures and wind speeds measured by radiosonde meteorological balloons. Problems of long distance blast prediction are discussed. It is pointed out that under some atmospheric conditions ducting can give a sound focus where very strong noise may be concentrated. Upper air meteorological records from the Katzebue, Alaska, area are reviewed to find sound patterns which may be expected from a full-scale explosion during the Chariot Project. It is concluded that the most serious problems faced in blast prediction are those of determining whether damaging ozonosphere signals will strike Katzebue during a fall firing or in Siberia from an early fall or spring firing. A program is planned to establish ozonosphere sound propagation patterns by small high explosive shots during the month preceding the major blast. (C.H.)

22705 UCRL-5676(p.67-70)
California. Univ., Livermore. Lawrence Radiation Lab.
EXCAVATION OF A HARBOR (PROJECT CHARIOT). Clifford M. Bacigalupi.

Project Chariot will be the first full-scale experimental excavation by the use of multiple nuclear explosives simultaneously detonated. The major objective of the experiment is to obtain cratering and effects information that can be applied to future excavation work. The Chariot site is located on the northwest coast of Alaska between Point Hope and Kotzebue and is approximately 110 miles north of the Arctic Circle. The precise location is called Ogotoruk Creek. Preliminary planning and field studies are described. (C.H.)

22706 UCRL-5676(p.71-88)
Sandia Corp., Albuquerque, N. Mex.
EXCAVATION OF A SEA-LEVEL SHIP CANAL. L. J. Vortman.

An investigation was made of the possibility of employing nuclear explosives to construct a sea-level ship canal in the vicinity of the Isthmus of Panama. A survey of the topography of possible routes resulted in the selection of the Caledonia Bay (Sasardi-Morti) route. This site is about 110 miles east of the present canal, in an unpopulated area, and the route follows valley bottoms and would require only a minimum of excavation. Fundamental concepts governing the use of nuclear explosives in canal construction are reviewed. Data are tabulated on spacing and yield of the nuclear explosives. Cost estimates are presented for a canal 600 feet wide and 60 feet deep. It is estimated that the cost of excavating a channel by nuclear means is about 16% of conventional costs. (C.H.)

22707 UCRL-5676(p.89-96)
Sandia Corp., Albuquerque, N. Mex.
CONSTRUCTION OF UNDERGROUND OIL STORAGE TANKS. Roland H. Carlson.

The use of nuclear explosives in the construction of caverns in impermeable rock for use as underground oil storage tanks is discussed. Problems are considered and it is concluded there are no obvious engineering or technical reasons why such a technique could not be used. Cost estimates are compared for the construction of a 7 million barrel underground storage cavity by conventional methods and by nuclear explosives. It is estimated that a savings of about $25 million would be realized by the use of nuclear explosives. (C.H.)

22708 UCRL-6081
California. Univ., Livermore. Lawrence Radiation Lab.
PLOWSHARE PROGRAM; PEACEFUL USES FOR NUCLEAR EXPLOSIVES. David B. Lombard. July 25, 1960. 19p. Contract W-7405-eng-48. OTS.

Presented at the 7th Annual Nuclear Science Symposium sponsored by the Office of Naval Research and the Idaho Falls Operations Office of the AEC, held at Idaho Falls, Idaho from July 25 to August 5, 1960.

The concept of thermonuclear explosives as a potentially cheap and almost inexhaustible energy source for mankind's nonmilitary needs has for several years been under active consideration at the Lawrence Radiation Laboratory. Many of the proposed peaceful applications involve underground nuclear explosions, and several experiments at the AEC Nevada Test Site have provided valuable insight into the phenomenology of such explosions. Among the possible uses currently under consideration are excavation, heat production, isotope production, mining, recovery of oil from shales and tar sands, improvement of ground water supplies, and the construction of earth-fill dams. In addition, a program of experimental research in the laboratory and in the field is under way. Sometime in 1961 Project Gnome if approved will be conducted in New Mexico. The purpose of Gnome, a contained nuclear explosion in a salt deposit, is to study the feasibility of heat recovery and isotope production; neutron scattering experiments will also be included. Other proposed nuclear projects will involve the creation of a small harbor near Cape Thompson, Alaska as the result of an experiment designed to investigate the cratering effects of nuclear explosives; a proposal to investigate the recovery of oil from Canadian tar sands using thermonuclear explosives is under consideration by the Canadian government. (auth)

22709
TRUDY INSTITUTA YADERNOĬ FIZIKI. TOM 1. (Papers of the Institute of Nuclear Physics. Vol. 1). I. G. Dem'yanikov, ed. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 1, 1-302(1958).

Twenty-six articles are presented on investigations carried out at the Institute of Nuclear Physics during 1954 to 1956. The articles include data on cosmic particle reactions with various substances and on properties of secondary particles. Special attention is given to meson production in showers and to the motion of charged particles in general relativity theory. The problems of plasticity, strength, and hardness variations of alloys at various temperatures in relation to their chemical and phase composition are analyzed, and data on crystallization processes and hot-hardness are examined. Articles on problems of spectral analysis, studies of arc operation, and methods of determining rare elements in ore are included as well as articles on x-ray spectral analysis of various series. (R.V.J.)

22710
RAPPORT ANNUEL, 1959. (Annual Report, 1959). Brussels, Institut Interuniversitaire des Sciences Nucléaires, [1960]. 227p.

The activities of l'Institute Interuniversitaire des Sciences Nucléaires for 1959 are reported. Administrative personnel are listed along with descriptions of conferences, trips, publications, and cooperative or collaborative work. Abstracts of publications of research by IINS workers in the open literature are given. (T.R.H.)

22711
Oak Ridge National Lab., Tenn.
RADIOISOTOPES, SPECIAL MATERIALS AND SERVICES. Catalog and Price List, 3rd Revision May 1960. 206p.

This catalog gives information on the ordering, availability, shipping, price, and production of radioisotopes. (W.L.H.)

22712
United States. Congress. Joint Committee on Atomic Energy.
TECHNICAL ASPECTS OF DETECTION AND INSPECTION CONTROLS OF A NUCLEAR WEAPONS TEST BAN. SUMMARY-ANALYSIS OF HEARINGS, APRIL 19, 20, 21, AND 22, 1960. JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, SECOND SESSION. 1960. 82p. GPO.

A summary is presented of the hearings on Technical Aspects of Detection and Inspection Controls of a Nuclear Weapons Test Ban held by the Special Subcommittee on Radiation and the Subcommittee on Research and Development of the Joint Committee on Atomic Energy of the Congress of the United States. Topics discussed include the possibilities and problems of nuclear test detection and control, including the basis of the original proposed Geneva control system of 180 stations; analysis of the basis for improvement of the Geneva system under present knowledge; consideration of means of concealment and muffling of tests; discussion of basis of on-site inspections; consideration of detection and identification of nuclear tests in outer space; discussion of technical significance of further weapons development through clandestine tests; and review of research and development programs aimed at improving capabilities for detection and identification of nuclear tests. Summaries are included of statements by a representative group of leading scientists and technical experts in this field and a panel discussion on the feasibility and capability of test ban control systems. A glossary and a list of witnesses who testified at the hearings are included. (C.H.)

BIOLOGY AND MEDICINE

General and Miscellaneous

22713 FZM-1984
Convair, Fort Worth, Tex.
NEW BIOLOGICAL-EXPOSURE CONSTANTS. J. C. Couchman. June 29, 1960. 21p.

Paper presented at the Summer Meeting of the Health Physics Society, Boston, June 29-July 1, 1960.

The fission-product nuclear data available in the literature were compiled on IBM-704 cards and used to obtain biological-exposure constants. These data were substituted into biological-exposure equations to obtain the energy absorbed per atomic disintegration and the rems exposure per curie deposited in each of 12 body organs. (W.D.M.)

22714 HW-62037
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
POTASSIUM, CESIUM-137 AND RUBIDIUM-86 RELATIONSHIPS IN PLANT UPTAKE, SOIL DIFFUSION RATES AND IRRIGATION PRACTICES. J. F. Cline. May 24, 1960. 12p. Contract AT(45-1)-1350. OTS.

Addition of potassium to the nutrient substrate reduced Cs^{137} and Rb^{86} uptake by plants, but less than expected from an assumed physiological equivalence of the ions. Discrimination between Cs^{137}-K or Rb^{86}-K varied with the concentration of potassium in the substrate. Cs^{137} was not moved appreciably through soil columns by water. Fifty per cent was leached from acid soil columns with 0.1 N KCl, but none was removed from alkaline soil. Flooding did not increase Cs^{137} uptake by rice plants over that observed when soil was not flooded. (auth)

22715 TID-6219
Creighton Univ., Omaha.
CA-45 AND Sr-85 METABOLISM IN MAN. Progress Report [for] June 15, 1959-May 20, 1960. 9p. Contract AT(11-1)-587. OTS.

Bone formation rate in a normal, healthy, young adult was observed to be 0.521 g calcium/day. Calcium balance and bone formation and destruction rates were studied in patients with disuse osetoporosis associated with quadriplegia secondary to poliomyelitis and patients with senile and posmenopausal osteoporosis. Renal strontium/calcium discrimination, studied for nine cases, was given by a mean factor of 4.3. This factor means that, exposed to trace amounts of strontium and normal calcium loads, the human kidney will produce a urine containing 4.3 atoms of strontium per unit filtered strontium for each atom calcium per unit filtered calcium. The mean value for gastrointestinal discrimination between endogenously secreted Sr^{85} and Ca^{45} was 1.4. The ratio of strontium- determined pool to calcium- determined pool was 1.04 ± 0.13 (1 S.D.) and the corresponding ratio for bone formation values was 1.04 ± 0.32 (1 S.D.) for nine patients studied. (C.J.G.)

22716 TID-6221
Johns Hopkins Univ., Baltimore.
FACTORS INFLUENCING THE METABOLISM OF COPPER AND IRON. Period covered: July 1, 1959 to June 30, 1960. July 11, 1960. 12p. Contract AT(30-1)-1816. OTS.

Experimental studies led to the postulate that the Cu deficiency often encountered in Mo toxicity results from the deposition of copper sulfide. The postulate predicted experimental dietary conditions for producing molybdate-induced Cu deficiencies of an acute nature in short periods of time. The drop in liver sulfide oxidase was determined to result from the voluntary food restriction of animals on the molybdate-containing diets. An analytical procedure for the determination of copper sulfide in animal tissues was developed. Preliminary experiments using this procedure supported the "sulfide theory" for the induction of Cu deficiency. Experiments revealed the ability of experimental animals to detect toxic levels of molybdate in the diet. Selenium toxicity responded to sulfate therapy in that the characteristic liver degeneration was prevented. A coenzyme form of vitamin B_{12} was determined to be indispensable to the activity of methyl malonyl—Co A isomerase, an enzyme functioning in the metabolism of propionic acid. (C.J.G.)

22717 TID-6307
Connecticut. Univ., Storrs.
RADIOACTIVE ZINC-65 IN MARINE ORGANISMS IN FISHERS ISLAND SOUND AND ITS ESTUARIES. Progress Report and Renewal Proposal. Donald M. Skauen. [1960?]. 5p. Contract AT(30-1)-2487. OTS.

Zinc concentrations in small quantities of moist tissue from oysters were reproducibly determined. It was found that to obtain Zn^{65} in measurable quantities above background larger quantities are required. The study and laboratory work disclosed that little is known about Zn in marine organisms; however, when the procedure for chemical separation of zinc from marine tissue is standardized, a routine zinc analysis will be conducted at nine collecting stations for an additional year or more. Future work is proposed in which Zn^{65} will be utilized in a study of the rate and extent of labeled salt uptake in oysters. An effort would be made to determine the effect of common anions so as to compare organic and inorganic zinc salts. (J.R.D.)

22718 UR-600
Rochester, N. Y. Univ. Atomic Energy Project.
OUTLINE OF COURSES IN THE DEPARTMENT OF RADIATION BIOLOGY AND ATOMIC ENERGY PROJECT, UNIVERSITY OF ROCHESTER. J. N. Stannard. July 22, 1960. 76p. Contract W-7401-eng-49. OTS.

A description is given of the courses offered by the Department of Radiation Biology (Atomic Energy Project) of the University of Rochester School of Medicine and Dentistry and of several collaborative programs. These courses, sponsored largely by the Atomic Energy Commission, include post-graduate training in Health Physics, Hospital Physics, Industrial Medicine, Biophysics, and Radiation Biology with general emphasis on the health problems arising from the development of atomic energy. Graduate degrees offered are M. S. and Ph. D. in Radiation Biology or in Biophysics. Many post-doctoral students work on an informal or apprenticeship basis. Close collaboration is afforded with the other departments of the University. (auth)

22719 UWFL-60
Washington. Univ., Seattle. Lab. of Radiation Biology.
POTASSIUM AS AN INDEX OF NATURALLY OCCURRING RADIOACTIVITY IN TUNA MUSCLE. Diptiman Chakravarti and Timothy Joyner. June 30, 1959. 11p. Contract AT(45-1)-540. OTS.

Determinations of the potassium levels of light and dark muscle tissues were made for tuna fish samples from the Central Pacific. The mean potassium content was determined to be 2.3 mg/g for these tissues and was used as an index to calculate the radioactivity to be expected from K^{40} at 4.2 dis/min per gram of wet tissue. The levels of potassium in light and dark muscle samples were not significantly different. (auth)

22720 CEA-tr-R-814
DE LA CONCENTRATION DES ÉLÉMENTS RADIOACTIFS DANS QUELQUES GROUPES D'ORGANSIMES AQUATIQUES. (The Concentration of Radioactive Elements in Certain Groups of Aquatic Organisms). D. I. Il'in (Ilhin), Yu. I. (Y.) Moskalev, and A. I. Petrova. Translated into French from Atomnaya Energ. 5, 171-4(1958). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2885.

22721
STUDY OF AIR DISTRIBUTION IN A HAY-VENTILATION SYSTEM USING RADIOISOTOPES. A. Suss, F. Baumgärtner, and A. Mannl (Technische Hochschule, Munich). Atompraxis 6, 138-42(1960) Apr.-May. (In German)

Radioactive argon (Ar^{41}) was used to examine air currents in a hay-ventilation system according to the "Aulendorf" method. The activity of the labelled air was automatically registered in 5 places. The results showed that air distribution in the haystack was not the same throughout. The experiments provided quantitative results for air distribution; these results gave a valuable basis for improvement. Although this method has not yet been worked out for other purposes it could also be used for examining other ventilation problems. (auth)

22722
AN APPARATUS FOR β-IRRADIATION OF SUSPENSIONS OF BIOLOGICAL OBJECTS. W. Füchtbauer and W. Simonis (Universität, Wurzburg, Ger.). Atompraxis 6, 217-19 (1960) June. (In German)

A simple apparatus which subjects an aqueous suspension of chloroplasts obtained from spinach leaves to a uniform irradiation of 3000r/min is described. The use of this apparatus in carrying out and evaluating the ferrous-ferric system of dosimetry is also reported. (auth)

22723
SPLENOPORTAL ISOTOPE CIRCULOGRAPHY. Z. Dienstbier, O. Andrysek, and J. Brousil (Charles Univ., Prague). Atompraxis 6, 219-21(1960) June. (In German)

A method was developed for splenoportal circulography by the use of isotopes; it is based on an injection of 10 to 20 μc of I^{131} in the spleen and registration of activity over the heart. It was found that a change in portal pressure produces a demonstrable change in registration. In this connection the advantages of registering rapid changes in activity by means of tape are presented. (auth)

22724
LABELING PLANTS WITH C^{14}. D. Sauerbeck (Universität, Bonn). Atompraxis 6, 221-5(1960) June. (In German)

A new setup for labelling plants with C^{14} is described in comparison with other methods used in the U. S. The new device differs from those known so far, particularly in that a sand-clay medium for plant growth instead of the usual water culture was used. This resulted in a remarkable technical simplification and much lower expense without a decrease in applicability. (auth)

22725
SIMPLE STRONTIUM DETERMINATION IN PLANT MA-

TERIALS USING A CATION EXCHANGER. K. Scharrert and S. Heilenz (Justus Liebig-Universität, Giessen, Ger.). Atompraxis 6, 226-7(1960) June. (In German)

An easy method for quantitative determination of strontium in plant substance is described. A solution containing dry charred plant substance was prepared, and the ions which would distort the measurement of strontium were separated by means of a cation exchanger. The strontium concentration in the resultant solution was determined by a spectrophotometric measurement with inner standards. (auth)

22726

SIMPLE METHOD FOR DETERMINING STRONTIUM-90 IN PLANT MATERIAL. E. Welte and U. Marckwordt (Landwirtschaftliche, Forschungsanstalt Büntehof, Hanover). Atompraxis 6, 228-9(1960) June. (In German)

A method for quantitative determination of Sr^{90} in plant material is described. In the course of analysis the substance was charred and the ash dissolved. Phosphate ions and hydroxides were separated from the solution. The alkaline earths were removed in the form of carbonates. From the radiochemical equilibrium between strontium and yttrium, yttrium was isolated and measured. No inactive strontium carrier was added. The calcium content of the sample served as a carrier for the strontium. The chemical yield was determined by adding Sr^{89}. (auth)

22727

PROBLEMATICS OF RADIATION INJURY THERAPY BY ORGAN TRANSPLANTATION (A LITERATURE SURVEY). J. Müller (Heiligenberg-Instituts, Heiligenberg, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 93, 238-55(1960) Aug. (In German)

A survey is presented of the newest results published up to the end of 1959 which refer to the therapy of radiation injuries which has been carried out by transplantation of organs. A description is given of the organs which are therapeutically important, of the possibilities of their preservation, of the technique of the transplantation of organs, and the dependence of the therapeutic success on the genetic relationship between the organisms of the host and of the donor. In order to decide the question of the principle which is therapeutically relevant, the identification and follow-up is required of the transplanted organ within the host. The methods are compiled which have been developed for this purpose, and their applicability to various problems is discussed. It is practically certain that transplanted cells live on in the host and are capable of further development. The effect is described of transplanted organs on the symptoms of radiation injuries and on single organs. The development and the symptoms of the secondary radiation injury are described, which are the consequences of homologous and heterologous transplantations for the irradiated organs. The changes of the immunization system which occur after irradiation are described. The secondary radiation injury is probably the result of mutual inhibitions and mutual adaptations of the immunization systems of the host and the donor. A principle, which is therapeutically relevant for transplantations of organs is that, the whole living cell must be considered with its further possibilities of development. The existence of humoral factors can neither be proved nor be excluded; the significance of possibly existing humoral factors is, however, unlikely to reach that of cellular factors. (auth)

22728

A RADIOMETRIC ASSAY OF TRITIATED TETRACYCLINE IN SERUM AND PLASMA OF LABORATORY ANIMALS. E. I. Takesue, G. Tonelli, Lucia Alfano, and D. A. Buyske (Lederle Labs., Pearl River, N. Y.). Intern. J. Appl. Radiation and Isotopes 8, 52-9(1960) May. (In English)

A combination of the availability of radioisotopically labeled tetracycline, automatic equipment for counting radioactivity, and the knowledge that this antibiotic in the rat is not appreciably metabolized suggested the feasibility of a radiometric assay procedure. Correlation studies between microbiological and radiometric assays on tritiated tetracycline in vivo and in vitro in serum and plasma of the rat and dog agree very satisfactorily. In the experiments involving the preparation of plasma samples, various anticoagulants were tried. Of these, heparin, but not oxalate, citrate, disodium ethylenediamine tetra-acetic acid, gave plasma concentrations which agreed closely with that found in the serum. Procedural simplicity, small sample requirements, rapidity, and accuracy appear to be sufficient to suggest that the radiometric method be employed in the evaluation of large numbers of samples, such as a screening program. This work is an example of the routine use of a tritiated compound in the search for therapeutics useful in human medicine. (auth)

22729

THE UTILIZATION OF NATURAL RADIOACTIVE ISOTOPES AT HEALTH RESORTS AND IN OTHER CONDITIONS FOR CURATIVE PURPOSES. E. S. Shchepotieva and S. N. Ardashnikov. Med. Radiol. 6, No. 6, 3-11(1960) June. (In Russian)

The paper is concerned with the physical and biological bases of current modes of general and local alpha therapy. Problems are discussed relative to the use of natural radioactive isotopes at health resorts and otherwise, as well as organizational and methodical measures, necessary for the further development of alpha therapy. (auth)

22730

PROPERTIES OF SEROTONIN. G. A. Chernov. Med. Radiol. 6, No. 6, 75-87(1960) June. (In Russian)

Biological applications and protective properties against radiation injuries of serotonin (3-(2-Aminoethyl)-5-Indolol) are reviewed. Extensive bibliographies are included. (R.V.J.)

22731

EFFECTS OF GIBBERELLIN, KINETIN, THIOUREA, AND PHOTOMORPHOGENIC RADIATION ON MITOTIC ACTIVITY IN DORMANT LETTUCE SEED. Alan H. Haber and Helen J. Luippold (Oak Ridge National Lab., Tenn.). Plant Physiol. 35, 486-94(1960) July.

The effects of several germination-stimulating agents on mitotic activity in radicles of nongerminated lettuce seeds were studied using conditions near the upper limits of temperatures permitting germination. Under appropriate conditions where gibberellin, kinetin, thiourea, and red light could stimulate germination, only kinetin stimulated mitotic activity. Kinetin can be considered a true cell division factor in nongerminated lettuce seeds. Neither gibberellin nor red light had any significant effect on mitotic activity under conditions where they were later active in stimulating germination. The conditions under which thiourea inhibited mitosis were the same as those under which it later stimulated germination. The results are discussed in relation to seed germination, the general problem of dormancy, and the actions of the germination-stimulating agents on other aspects of growth and development. (auth)

22732

STRUCTURE AND ORIENTATION OF FREE RADICALS FORMED BY IONIZING RADIATIONS IN CERTAIN NATIVE PROTEINS. Walter Gordy and Howard Shields (Duke Univ., Durham, N. C.). Proc. Natl. Acad. Sci. U. S. 46, 1124-36 (1960) Aug.

Studies of the doublet pattern in the electron spin resonance of free radicals produced by irradiation of proteins indicated that it must arise from a proton on the CH group within the free radical. Analysis of the electron spin resonance of irradiated silk revealed a doublet of 26 gauss separation for silk strands parallel to the field and an incompletely resolved doublet of 13 gauss separation for the strands perpendicular to the field. These observed features were accounted for by the assumption of the free radical which would be formed by the loss of the R. group from a unit section of the polypeptide chain. An analysis of the electron spin resonance of an irradiated feather quill showed a superposition of the silk-like doublet and the cysteine-like resonance. From these studies it was determined that the two principle sites of radiation damage to proteins were the α-carbon in the polypeptide backbone and the sulfur atom of a side chain of the capture or cystine residue. Structural arrangement and the nature of coiling were found to influence the movement of electron vacancies within proteins. (M.C.G.)

22733

TEMPERATURE EFFECTS ON FREE RADICAL FORMATION AND ELECTRON MIGRATION IN IRRADIATED PROTEINS. Frank Patten and Walter Gordy (Duke Univ., Durham, N. C.). Proc. Natl. Acad. Sci. U. S. 46, 1137-44 (1960) Aug.

Electron vacancy, or electron spin density, caused by irradiation was found, at room temperature, to migrate through the protein from the multiple sites where the ionizing radiation struck to the few sites where the spin density was finally detected. Such migration did not occur at the temperature of liquid nitrogen, 77°K. From the shape of their resonances, it was concluded that when silk and feather quill were irradiated at temperatures as low as 77°K, several types of free radicals were produced. When the proteins irradiated at lowered temperatures were allowed to warm to room temperature, these complex patterns were usually converted to the simple pattern of a single free radical. This radical was the one characteristic of that protein irradiation at room temperature. A possible mechanism for this formation of characteristic free radicals is described. (M.C.G.)

22734

NEW METHODS IN BIOPHYSICAL RADIATION BIOLOGY. Boris Rajewsky and Helmut Pauly (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 112, 489-500(1960) Aug. (In German)

A brief introduction of the historical development and the basic physical conditions of the hit theory, which gives new ways in the field of the analysis of the radiation effect and the metabolism of the cells is presented. The extension of the hit theory by means of reaction kinetics is discussed together along with tissue respiration. The treatment of time dependence as a model of biological recovery is introduced by the example of luminating bacteria. Some new results of studies about radio-chemical separation and combination processes of amino acids and electron resonance spectra following x-irradiation of fibro-proteins are presented. Most of the experiments mentioned were performed in the Max-Planck-Institute for Biophysics. (auth)

22735

A TELECOBALT APPARATUS WITH COMPLETE RADIATION PROTECTION. László Bozóky (National Inst. for Oncology, Budapest). Strahlentherapie 112, 629-33(1960) Aug. (In German)

A telegamma unit for a Co^{60} source with complete radiation protection was designed. The physical and technical properties are described. A radiation burden for the personnel does not exist. The gravitation power is used for the operation of the machine. Besides for the treatment of patients the unit is suitable for various scientific studies. (auth)

Biochemistry, Nutrition, and Toxicology

22736

DISTRIBUTION OF S^{35} IN MICE AFTER INJECTION OF S^{35}–CYSTEAMINE. AN AUTORADIOGRAPHIC INVESTIGATION. Arne Nelson and Sven Ullberg (Research Inst. of National Defence, Sundbyberg, Sweden and Royal Veterinary Coll., Stockholm). Acta Radiol. 53, 305-13(1960) Apr. (In English)

The distribution of S^{35} in mice was investigated by a whole-body autoradiographic survey method after the administration of S^{35}-cysteamine. The uptake in the tissues, organs, and fluids of the body is described and discussed. (auth)

22737

FUMARASE ACTIVITY IN D_2O. John F. Thomson (Argonne National Lab., Ill.). Arch. Biochem. Biophys. 90, 1-6(1960) Sept.

The initial rate of conversion of fumarate to malate in the presence of crystalline fumarase was decreased when the reaction was carried out in the presence of D_2O; the reverse reaction was inhibited to a lesser extent. The maximum rate for the forward reaction was inhibited about 60% in 100% D_2O; for the reverse reaction, the inhibition was about 33%. Under physiological conditions at the maximum D_2O concentration tolerated by mammals the predicted inhibitions were 20 and 10%. In agreement with other investigators, the apparent equilibrium constant was found to be lower in D_2O than in H_2O. (auth)

22738

ON THE MECHANISM OF ENZYME ACTION. LXX. UREA DENATURATION OF TRYPSIN AND ACYLTRYPSINS. J. F. Riordan, M. Bier, and F. F. Nord (Fordham Univ., New York). Arch. Biochem. Biophys. 90, 125-31(1960) Sept.

Trypsin and its acetyl and succinyl derivatives were exposed to urea solutions of various concentrations. The resulting changes, as measured by activity and sedimentation studies, are due to denaturation, both reversible and irreversible, and to self-digestion. The effect of acylation on these processes is discussed, and in addition the sequence of steps leading to the final inactive product is considered. The action of urea is compared to that of heating the enzymes, and the similarities are indicated. (auth)

22739

ON THE MECHANISM OF ENZYME ACTION. LXXI. ACYLATIONS OF TRYPSIN IN ORGANIC SOLVENTS. S. M. Vratsanos (Fordham Univ., New York). Arch. Biochem. Biophys. 90, 132-8(1960) Sept.

Acetylation of trypsin in dimethyl sulfoxide solutions is a reaction highly specific for the free amino groups of the enzyme. The progressing acetylation causes a gradual reduction of the activity characterized by a complete inactivation upon the introduction of about 15 acetyl groups per trypsin molecule. By increasing the bulk of the substituent acyl group, this number is reduced. The inactivation caused by the substitution is apparently associated with a specific configuration that the enzyme assumes in the organic solvent. In formamide the introduction of acetic anhydride results in formylation rather than acetylation. The observation of inactivation in the presence of trypsin competitors for the utilization of the reagent offers a sensitive means of evaluation of the reactivities of various functional groups of proteins. (auth)

22740

STUDIES OF RADIO CONTAMINATION OF FOODSTUFFS EFFECTED BY ATOMIC OR HYDROGEN BOMB EXPLOSION. IX. RADIO CHEMICAL ANALYSIS OF RADIO CONTAMINATED FISH LIVERS IN 1958. Kakuma Nagasawa, Yosihiko Kasida, Katsuaki Kametani, and Yasumasa Kido. Eisei Shikenjo Hôkoku 77, 453-65(1959). (In Japanese)

The contamination in 224 livers of tunny and sword fish caught in the Pacific Ocean was examined. As a result of radiochemical analysis in the four samples, Fe^{59}, Zn^{65}, Sr^{90}, Y^{90}, and Cd^{115m} were identified. The maximum concentrations of the elements determined were Fe^{59}, 1.58×10^{-4} μc; Zn^{65}, 4.58×10^{-3} μc; Sr^{90} and Y^{90}, 8.33×10^{-7} μc; and Cd^{115m}, 3.66×10^{-4} μc. When 10 g of wet sample was assumed to be the daily personal intake dose, these were less than the maximum permissible concentrations. (auth)

22741

ON INTERMEDIATE NUCLEOTIDE METABOLISM IN THE NORM AND RADIATION DISEASE. G. A. Kritskii (Inst. of Biochemistry, Academy of Sciences, Moscow). Izvest. Akad. Nauk S.S.S.R., Ser. Biol. No. 4, 519-32(1960) July-Aug. (In Russian)

In the course of biochemical transformations of the elementary purine precursors, such as glycine, CO$_2$, and formic acid, there are formed, besides intermediary products of purine biosynthesis, also malic, glycolic, succinic, and fumaric acid as well as other by-products. It is confirmed that biosynthesis of the purine ring involves a stage of ribosidation of the purine precursors. The composition and metabolism of purine and pyrimidine compounds of bone marrow were studied. In the bone marrow there were detected adenylic, guanylic, inosinic, and uridilic acids, hypoxanthine, and uracil, as well as other low molecular purine and pyrimidine compounds. The content of these compounds greatly decreases in the bone marrow within the first days following x irradiation. Autolytic decomposition of RNA in the bone marrow increases directly after x irradiation but is greatly inhibited during the following days. A brief literature review is presented on intermediate nucleotide metabolism in the norm and in radiation disease. Disturbances of nucleotide metabolism, especially in autolitic splitting of nucleic acids, are considered as the primary and most essential metabolic disturbances caused by ionizing radiations in the organism. (auth)

22742

DISTRIBUTION OF CERIUM AND RUTHENIUM IN THE ORGANS OF RAT FOLLOWING THEIR INTRODUCTION BY INHALATION. L. A. Buldakov, Yu. I. Moskalev, and D. I. Semenov. Med. Radiol. 6, No. 6, 42-7(1960) June. (In Russian)

Data are presented on the distribution of cerium and ruthenium in the organs of rat following introduction by inhalation. (auth)

22743

TOXIC EFFECT OF RADIOACTIVE IODINE WITH SINGLE PER OS ADMINISTRATION. O. N. Gorbunov, V. G. Ryadov, and Yu. A. Klassovskiĭ. Med. Radiol. 6, No. 6, 69-74(1960) June. (In Russian)

On the basis of experiments on dogs it was established that a single oral administration of I^{131} (0.25 mc/kg) could induce serious and prolonged changes not only in the thyroid gland, but in the liver and bone marrow as well. (auth)

Fallout and Ecology

22744 A/AC.82/R.80

United Nations. Scientific Committee on the Effects of Atomic Radiation.

STATUS REPORT ON THE FOOD CHAIN. Dec. 14, 1959. 71p.

Present knowledge and the expected future levels of contamination that must be taken into account in considering the biological effects of radioactivity transmitted through the food chain were summarized. The fission yield from the total testing of all nations by the end of 1958 was estimated as 92 MT. The total estimate of Sr^{90} and Cs^{137} production was 9.2 Mc and 13.5 Mc, respectively, and Pu^{239} production was calculated as 0.5 Mc. Strontium-90 in relation to calcium was studied in milk and milk products, cereals, flour, vegetables, fruits, eggs, meat, and fish. The intake in humans and distribution in the bones were investigated. Cesium-137 was studied in relation to potassium in milk and other food items. The environmental incorporation and distribution of Cs^{137} and its levels in human beings were determined. The relationship between fall-out and food contamination was studied. (M.C.G.)

22745 UCRL-5676(p.60-6)

Division of Biology and Medicine, AEC.

THE ECOLOGICAL ASPECTS OF PROJECT CHARIOT. John N. Wolfe.

The ecology of the Cape Thompson area is described. An outline is presented of proposed pre-detonation surveys to be used as a basis for assessing the total effects of such programs on the biosphere. Other objectives of the Chariot Project are also outlined. (C.H.)

22746

RADIOACTIVE CONTAMINATION OF MILK AND MILK PRODUCTS IN JAPAN. Rinjiro Sasaki, Tomokichi Tsugo, Susumu Koyama, Tatsuo Sato, and Yoichiro Omomo (Tokyo Univ.). Bull. Agr. Chem. Soc. Japan 24, 105-11(1960). (In English)

Radioactive contamination of milk and milk products in Japan was studied extensively. Samples were collected monthly or every season from several districts of Japan. Total radioactivity of raw milk and skim-milk powder and Sr^{90} concentration of skim-milk powder and sweetened condensed milk were measured. These experiments show that there is neither seasonal variation nor regional variation in total radioactivity and that in the measurements of Sr^{90} concentration the values in northern districts are higher than those in other parts of Japan. (auth)

22747

THE ABSORPTION OF LONG-LIVING BETA EMITTERS BY PLANKTON. A. F. Fedorov (Knipovich Arctic Research Inst. of Fishing Industry and Oceanography, USSR). Med. Radiol. 6, No. 6, 51-4(1960) June. (In Russian)

A definite regularity was revealed in the absorption of a mixture of beta emitters by plankton organisms. (auth)

22748

POLLUTION OF RESERVOIR SURFACES WITH RADIOACTIVE SUBSTANCES. S. M. Drachev and A. A. Bylinkina (Sysin Inst. of General and Communal Hygiene, Academy of

Medical Sciences, USSR). Med. Radiol. 6, No. 6, 54-8 (1960) June. (In Russian)

A concentration of radioactive substances was observed on the surface of practically clean reservoirs and rivers which are polluted with industrial effluents. The concentration was assessed by collection of surface films in the reservoirs and investigation of the foam collected in rivers, lakes, and reservoirs. The concentration of β-radiating substances in the foam increases 100 to 1000 times. The cause of concentration of radioactive substances is not only a temporary, mechanical detention of atmospheric radioactive fall-out on the surface of reservoirs, but also more complex phenomena, among which the major part is attributed to the flotation of dispersed solid particles, which are always present in the foam samples. (auth)

22749

THE Sr^{90} CONTENT IN MILK IN CERTAIN AREAS OF CZECHOSLOVAKIA. Ya . Nosek and V. Santgolzer. Med. Radiol. 6, No. 6, 58-60(1960) June. (In Russian)

On the basis of pertinent data a conclusion is drawn on the decrease of the radioactivity of the fall-out as a direct result of temporary cessation of nuclear tests. (auth)

22750

THE OCCURRENCE OF RADIOSTRONTIUM IN FOODSTUFFS. J. Hawthorn (Royal Coll. of Science and Tech., Glasgow). Proc. Nutrition Soc. (Engl. and Scot.) 18, 44-8(1959).

Data are tabulated on the mean daily intake of strontium-90 in the diet of persons in the United Kingdom during 1958. Corresponding values for calcium are included. The effects of levels of milk and of food preparation and cooking on radiostrontium levels are discussed. (C.H.)

Radiation Effects on Living Tissues

22751 A/AC.82/G/R.208

Akademiya Nauk S.S.S.R.

THE CYTOGENETIC EFFECTS OF RADIATION EXPOSURE ON SPERMATOGENESIS IN MONKEYS. 1957. 18p.

Results of cytological studies of spermatogenesis in monkeys that were subjected to total x-ray exposure of 150 to 450 r are presented. It was found that such doses produce extensive damage in various cells and at various stages of spermatogenesis. Resulting disturbances and abnormalities are discussed, and conclusions are given. (J.R.D.)

22752 A/AC.82/R.84

United Nations. Scientific Committee on the Effects of Atomic Radiation.

THE RELATIONSHIP BETWEEN THE DOSE AND THE EFFECTS OF IRRADIATION OF MAMMALS WITH ESPECIAL REFERENCE TO THE LOW-DOSE REGION. Dec. 18, 1959. 69p.

Data on the relationship between the radiation dose and its somatic effects, those apparent in the irradiated generation, in mammals were collected in order to determine whether any dose of radiation was followed by those effects or if a threshold dose existed below which no effect occurred. The effects studied were acute death, body weight loss and organ atrophy, depression of mitotic activity, induction of lens opacity, depression of iron uptake by erythrocytes and erythrocyte-forming tissue, suppression of defense mechanisms, induction of tumor development, radiation-induced leukemia in man, and shortening of the life-span. No experiments performed were able to give conclusive evidence of the existence or non-existence of the threshold. (M.C.G.)

22753 HW-63499

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

BIOLOGICAL EFFECTS OF Sr^{90} IN MINIATURE SWINE. I. EXPERIMENTAL DESIGNS AND PRELIMINARY OBSERVATIONS. W. J. Clarke and J. R. McKenney. Jan. 12, 1960. 11p. Contract AT(45-1)-1350. OTS.

The experimental design and preliminary results are described for a study undertaken to estimate the maximum permissible daily intake for Sr^{90} in man and his offspring by means of daily feeding of this radioisotope to miniature swine. Extrapolation of these experimental results to man will be attempted by the study of comparative toxicity of Sr^{90} and Ra^{226} in these animals. Results after nine months of daily ingestion of 1, 5, or 25 μc of Sr^{90} are inconclusive. No significant observable effects were noted in any of the adult feeding levels. The first generation offspring from the 25 μc adult swine, however, showed a slight trend toward lower birth and weaning weights, and a tendency toward microcytic anemia. The comparative toxicity animals, at one month following injection of their respective radioisotopes, evidenced no skeletal pathology as determined by clinical and x-ray examination. Certain blood constituents in these animals, however, showed tendencies toward lower values when compared to the controls. (auth)

22754 LA-1987(Del.)

Los Alamos Scientific Lab., N. Mex.

BIOLOGICAL EFFECTIVENESS OF NUCLEAR RADIATIONS FROM FISSION WEAPONS. Payne S. Harris. Aug. 1955. Decl. with deletions Nov. 25, 1959. 51p. OTS.

Thermal neutron measurements made on five weapons during Operation Teapot indicated that these neutrons contribute at most 2% of the total neutron dose in air. However, the total fluxes were high and thermal neutrons may become important under certain shielding conditions and may significantly affect the response of the film badges and certain sensitive dose detectors, especially when the neutron to gamma flux ratio is high. The fast neutron measurements indicated the varying importance of fast neutron dose depending on weapon type. The measurements also showed spectral invariance in rather wide energy bands over one to six mean free paths from point of detonation. The variation of flux seen by any single detector was found to be a variant of weapon design. Chemical dosimetric systems showed that gamma dose inside lead shields used for animal studies was due to neutron-gamma interaction in lead and constituted less than 10 per cent of the total radiation dose inside the shields. Also, gamma dose measurements in air using the chemical systems compared well with film badge measurements made in air at this and previous tests. The biological results showed that the RBE of fission neutrons between 100 and 1000 rem was 1.7 when spleen-thymus weight loss in mice was used as the end-point. Secondly, it was shown that additivity of neutrons and gamma rays varied with the neutron to gamma ratio. Finally, at very high doses and very high dose rates the RBE of neutrons appeared to decrease when median survival time was used as the biological endpoint. Using previous test results and the Teapot findings, it was possible to determine neutron and gamma dose versus distance curves for other fission weapons, in particular for those of the Japanese detonations. On the basis of these curves, the human effects observed in Japan were correlated with physical dose, and estimates of various parameters of effect in humans were made. These included the RBE of fission neutrons for acute death in humans, 1.6 ± 1.6; the LD$^{30}_{50}$ for humans, ~700 rem; the SD$_{50}$ (acute) in humans, ~275 rem; and the distribution curve for 30-day death in a human population. A discussion of the errors in the above estimates is included. (auth)

22755 NP-8877
California. Univ., Los Angeles. School of Medicine.
THE INFLUENCE OF IRRADIATED LIPIDS ON THE INCIDENCE OF SPONTANEOUS MAMMARY CARCINOMA AND HEPATOMA IN STRAINS A He AND C$_3$ H MICE. Final Report [for] November 1, 1957—November 1, 1959. Ralph W. McKee and Louis J. Zeldis. 30p. Contract DA-49-007-MD-579.

The effects of feeding a diet containing bacon that had been irradiated with 5.58 megarads to mice were studied. No significant differences in rate of growth or incidence of spontaneous mammary carcinoma and hepatoma were found between control animals and those maintained on non-irradiated bacon lipid and irradiated bacon lipid diets. (auth)

22756 USNRDL-TR-431
Naval Radiological Defense Lab., San Francisco, Calif.
COMPARATIVE EFFECTS OF FAST NEUTRONS AND X RAYS ON MARROW DEOXYRIBONUCLEIC ACID (DNA) CONTENT IN MICE. W. E. Davis and L. J. Cole. June 20, 1960. 20p.

The desoxyribonucleic acid (DNA) content of femur marrow (a measure of cellularity) was used as criterion for the relative biological effectiveness (RBE) of simulated fission neutron and x rays (250 kvp). DNA measurements were made at 2 to 24 hr post-irradiation; subsequently at 2 to 14 days, and DNA was determined. Time vs. DNA content curves for fast neutrons (33 to 240 rad) and for x rays (46 to 800 rad) were characterized by an early depletion (within 2 to 4 hr), and by recovery, the time and extent depending on dose. After 33 rad of neutrons, 46 rad of x rays, recovery was first evident at 15 hr; after 66 rad or 140 rad at 20 to 24 hr; after 139 or 225 rad at 2 days. Three days after 160 to 365 rad of neutron or 390 to 740 rad of x rays, the DNA content dropped from 1100 μ gm per femur pair (normal) to 300 to 400 μ gm, and this level persisted until death or until recovery occurred. Dose-response curves for neutrons and x rays were essentially identical (i.e., RBE-1) when plotted at 15 or 24 hr post-irradiation. When the dose-response data for DNA content were plotted at 2, 3, or 6 days post-radiation, the respective curves for x rays vs. neutrons were different. RBE values were as follows: at 2 days, 2.0; at 3 days, 2.1; at 6 days, 2.7. The data suggest that the higher RBE of neutron radiation in producing cellular depletion in marrow may be due to its greater effectiveness in delaying bone marrow regeneration. (auth)

22757 USNRDL-TR-432
Naval Radiological Defense Lab., San Francisco.
A MEASURE OF ACUTE RECOVERY AND OF RESIDUAL RADIATION INJURY TO ERYTHROPOIETIC SYSTEM OF RATS GIVEN REPETITIVE X-RAY EXPOSURES. S. J. Baum. June 27, 1960. 18p.

Rats exposed repeatedly to 300 r x rays show a decrease in Fe^{59} incorporation which attains its lowest point 48 hours post-irradiation. Thereafter iron uptake increases until normal values are measured. This return to normalcy is delayed further with each newly repeated irradiation. On any day during the recovery period Fe^{59} uptake decreases exponentially with repeated x irradiations. The decrease is a measure of residual injury to the erythropoietic system. Since it was demonstrated that after each repeated irradiation a reduced amount of Fe^{59} was incorporated into newly formed erythrocytes at the beginning of the recovery period while the rate of recovery is similar, it is postulated that the decrease in Fe^{59} uptake is due to a decrease in the functional capacity of the stem cells to proliferate erythrocytes. A working hypothesis for the calculation of erythrocyte stem cell damage was presented. This calculation indicates that only 77 to 80% of the previously measured amount of erythrocyte precursors were present after each repeated x-ray exposure. Red cell mass and hematocrit values measured after the animals had recovered from the effects of irradiation indicate that despite the reduction in the functional capacity of the stem cells to proliferate erythrocytes, the daily red cell turnover is nearly normal. The data indicate that only when this is reduced below a certain limit does a permanent anemia ensue. (auth)

22758 CEA-tr-R-777
ACTION PRÉVENTIVE DE CERTAINS COMPOSÉS PHARMACOLOGIQUES DANS LES TRAUMATISMES OCCASIONNÉS PAR DES RAYONNEMENTS. (Prophylactic Effects of Certain Pharmacological Compounds in Radiation Injuries). S. Ya. (I.) Arbuzov. Translated into French from Vestnik Akad. Med. Nauk S.S.S.R. 13, No. 6, 10-21 (1958). 26p.

Results of studies of the radioprotective effects of selected pharmacological compounds are collected and discussed. Data are presented on toxicity and effectiveness of chlorohydrate, salicylate, nicotinate, and ascorbinate of mercaptoethylamine; protective effects of phenatine, methylphenatine, and their combination with mercaptoethylamine nicotinate; protective effects of inithiol, mercaptocaffeine ethylamine, octaethylpyrophosphoric acid tetramide, aminasine, phenatine, aminasine—phenatine mixture, sodium chlorophyllate, β-cytosterol, and becaptan. (T.R.H.)

22759 JPRS-5029
COSMIC BIOLOGY. V. Parin and V. Yazdovskiĭ (Yazdovskiy). Translated from p.1176-82, Vol. 13, 2nd Ed., "Bol'shaya Meditsinskaya Entsiklopediya." (A publication of the Central Medical Publishing House (MEDGIZ) Moscow, 1959). 14p. OTS.

Soviet biological research in high-altitude rockets and in the second artificial earth satellite demonstrated the normalization of the physiological functions of animals after the satellite goes into orbital flight. The dogs tolerated the ascent with the motors on and the state of weightlessness with the motors off and during orbital flight in a satisfactory manner. The accumulation of data by means of rockets and artificial earth satellites has made it possible to solve many medical-biological problems associated with the penetration of man into cosmic space. However, flight in the upper layers of the atmosphere and beyond will inevitably subject man to the effects of a multitude of extremely unfavorable environmental factors. Among these are the high degree of rarefication of the air and resulting low barometric pressure, the absence of molecular oxygen and the high concentrations of ozone in certain layers of the atmosphere, ultraviolet radiation, cosmic rays and other types of ionizing radiation, meteorites which threaten the sealed cabins, high and low temperatures, and a prolonged state of weightlessness, which will create unusual conditions for the activity of the circulatory, respiratory, and digestive systems and the elimination of body wastes. Under conditions of cosmic flight man will be deprived of most of his customary exteroceptive stimuli such as light and sound, and the proprioceptive and interoceptive stimuli will probably be limited under conditions of weightlessness.

Psychological disorders as well as vegetative disturbances may result from man's staying in an isolated cabin of limited size for a long time under the conditions imposed by space flight. The problems of providing the crew members of a space ship with oxygen, food, and water, the development of diets, provision for reserves for a long flight, and the need for strictly limiting the weight dimensions of the contents of the space ship are very complex. At the present time (1959), Soviet investigations in the field of cosmic medicine consist of laboratory experiments in which conditions are created which imitate the effect of various factors of cosmic flight and medical-biological investigations using rockets and stratosphere balloons in which animals are subjected to the comprehensive effect of a number of factors which create conditions similar to those expected during cosmic flight. The essential difference consists in the duration of the flights. It has been shown that at an altitude of 15,000 meters with a barometric pressure of about 87 millimeters of mercury, respiration becomes impossible, even with the inhalation of pure oxygen; at an altitude of 19,200 kilometers the fluids in the bodies of warm-blooded animals begin to boil; at an altitude of 36,000 to 40,000 meters the injurious effects of the primary cosmic rays are encountered; at an altitude of 42,000 to 45,000 meters the effects of ultraviolet rays with a wave length of 3,000 to 2,000 A is superimposed on the effects of cosmic radiation; beginning with 100 to 120 kilometers from the surface of the earth, the danger of encountering meteorites appears; still higher the conditions for the propagation of sound waves are lost, the phenomenon of light scattering disappears, unusual lighting conditions are created, and there are sharp contrasts between intensely lighted surfaces and those in the shadow; normal space perception and depth perception become impossible, and conditions for retinal adaptation, accommodation of the lens, and convergence of the eyeballs are unusual. Data accumulated by means of high-altitude rockets and artificial earth satellites indicate that the greatest danger to man in space is presented by ionizing radiation occurring as the result of the interaction of cosmic radiation with the magnetic field of the earth which is like an electron flux possessing high energy and moving in a meridinal direction. This area of radiation extends from altitudes of 500 kilometers to several scores of thousands of kilometers from the earth's surface and at its maximum reaches 5 to 10 r/hour. The intensity of this radiation varies within a tremendous range depending on the geomagnetic latitude, distance from the earth, periods of solar activity, sun spots, and apparently other factors which were not yet clarified. Experience which was accumulated to date show that accelerations connected with leaving the earth's gravitational field as well as with the return to the earth can well be endured by man. The study of the biological effect of cosmic radiation, particularly of its heavy component, is considered extremely important to the success of space exploration. (C.H.)

22760 JPRS-5274

APPLICATION OF HIGH ENERGY RADIATION FOR THE BLOODLESS DESTRUCTION OF BRAIN TISSUE. G. A. Zedgenidze. Translated from Vestnik Akad. Med. Nauk S.S.S.R. 15, No. 4, 57-62(1960). 8p. OTS.

A review is presented of the history and development of bloodless destruction of brain tissue. Modern equipment and recently devised techniques are discussed. (T.R.H.)

22761

RADIATION LEUKEMOGENESIS. AN ANALYSIS OF THE PROBLEM. E. P. Cronkite, William Moloney, and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). Am. J. Med. 28, 673-82(1960) May.

Data are now adequate to indicate that, for high level, single dose exposure of man, the incidence of leukemia is approximately linear with dose. At dose levels of perhaps 100 r equivalent or greater, the incidence is approximately 1 to $2/10^6$ persons at risk/year/rad, at least from approximately the second to the fifteenth year following exposure. Below dose levels of approximately 100 r equivalent, the available data are inadequate for prediction. Data are inadequate for prediction for other than the single acute dose, i.e., it is not known if a dose-rate dependency exists. It is not known if the risk continues beyond approximately the first fifteen years from exposure. Although there is evidence that large dose radiation of sizeable portions of the marrow may be leukemogenic, there are no adequate grounds for assuming that the highly localized radiation from internal emitters such as Sr^{90} and radium are or are not leukemogenic. It is not possible to determine whether or not a threshold dose for the induction of leukemia does or does not exist. (auth)

22762

PROTECTION OF THE EMBRYO AGAINST THE CONGENITAL AND LETHAL EFFECTS OF X-IRRADIATION. PART I. R. Rugh and E. Grupp (Columbia Univ., New York). Atompraxis 6, 143-8(1960) Apr.-May. (In English)

The effects of 15 agents, some given before and some after x irradiation to 200 r, have been studied for their effectiveness in protecting the 8.5-day mouse embryo against embryonic or fetal death and the development of the severe cephalic congenital anomaly known as exencephalia (or brain hernia). Some 4979 fetuses were examined. Of the agents studied, only cysteinamine, cystamine, and anoxia proved to be statistically "protective" at all. Cysteinamine and cystamine (both -SH compounds) given I.P. before x irradiation to 200 r allowed 73 to 80% of the 8.5-day embryos to survive to term while the untreated but irradiated control litters had a survival of only 41%. Further, there was considerable reduction in both uterine death and the congenital anomaly of exencephalia. Anoxia (6% O_2 + 94% N_2) allowed 71% to come through as "apparently normal," an increase of 30% over the unprotected irradiated controls. Whether there is long-term damage to the 8.5-day embryo from the temporary anoxia alone has not been determined, although the anoxic controls showed 96% "apparently normal." Distilled water given I.P. before irradiation, making the milieu of the embryos hypotonic, appeared to be deleterious, causing 2% exencephalia even without x irradiation. When combined with x rays, distilled water reduced the "apparently normals" to 31%, or 10% lower than with irradiation alone. Saline in various concentrations was not protective. None of the tissue homogenates (spleen, marrow, liver, or brain of a homologous newborn source) proved to be of any protective value. It is suggested that the protective element in such tissue homogenates may be cellular since the placenta acts as the most efficient filter to allow only the dialyzable substances through to the embryo. However, the fact that the 8.5-day mouse embryo has not yet developed its hematopoietic system may explain the failure of homogenates which seem to protect through hematopoietic regeneration. Hypoxia from hypoglycemia following insulin injection was not protective. Insulin or dextrose or the two in combination were not particularly harmful to the 8.5-day mouse embryo but when combined with x irradiation were very damaging. "Protection" as used in this study is statistical and relates to the percentage changes in "apparently normal" fetuses, resorptions, deaths, and congenital anomalies. It does not imply that the surviving mice are without irradiation sequelae. In fact, many of the "apparently normals" have eye defects, and this might well reveal other and more subtle C. N. S. damage. On the basis of survival, however, cysteinamine, cystamine, and anoxia did afford some protection. (auth)

22763

PROTECTION OF THE EMBRYO AGAINST THE CONGENITAL AND LETHAL EFFECTS OF X-IRRADIATION. PART II. R. Rugh and E. Grupp (Columbia Univ., New York). Atompraxis 6, 209-17(1960) June. (In English)

Fifteen so-called "protective agents" have been used in connection with 200 r x-ray exposure of the 8.5-day mouse embryo to determine their effectiveness in reducing intrauterine death, resorption, and the induction of congenital anomalies. Some 506 pregnancies and 4979 implantations were studied. Only cysteinamine and cystamine (both SH-compounds) and anoxia proved effective. Distilled water injected I.P. with or without x irradiation was deleterious, and various concentrations of saline were ineffective. Tissue homogenates (spleen, marrow, liver, or brain of newborn homologous source) were ineffective. This factor suggested that either the tissue homogenates act through hematopoietic regeneration (the 8.5-day mouse embryo has no hematopoiesis) or the placental barrier excludes the cellular components of these homogenates, indicating that they are the effective agent. While "protection" is statistical, allowing x-irradiated embryos to survive and come to term, it is not implied that these survivors are in fact "normal." Many have eye defects, and it is likely that all mouse embryos exposed at 8.5 days to 200 r have permanently damaged central nervous systems, at least to some degree. (auth)

22764

STORAGE BEHAVIOR OF POTATOES EXPOSED TO X RAYS. A. Berger (Bundesforschungsanstalt für Lebensmittelfrischhaltung, Karlsruhe, Ger.). Atompraxis 6, 301-8(1960). (In German)

It was shown that x rays of very slight hardness can be used to prevent sprouting in potatoes. During irradiation it is best to turn the potatoes so that each point of the surface is exposed. The total dose can be determined by taking the dose required to produce the same effect on a flat object and multiplying it by four, if it is assumed that irradiation takes place at a distance considerably greater than the diameter of the potato. Late irradiation of two different strongly-sprouting potato types is more effective at the time of sprouting than is irradiation shortly after the quiescent period. Together with the decrease in sprouts there is a lessening of shrinkage due to water loss. Proper storage conditions can further reduce this shrinkage in potatoes which have not sprouted; good results can be obtained by storing the potatoes in perforated polyethylene bags. Slighter doses of soft x rays affect the later sprouts in a way similar to the mechanical removal of the first sprouts. The behavior of these later sprouts can be interpreted as a correlative inhibition of the reserve sprouts during the growth of the main sprouts. (auth)

22765

ON THE PROBLEM OF THE RADIATION SENSITIVITY OF DRY SEED. A. Micke and K. Wöhrmann (Universität, Göttingen, Ger.). Atompraxis 6, 308-16(1960). (In German)

Germination, sprouting, and survival values are given for 41 genetically different seed types after x-ray irradiation of from 5 to 120 kr. Certain causes of varying radiation resistance are pointed out. Germination tests carried out on irradiated and non-irradiated seeds which were stored for 1 to 3½ years reveal basic differences between inability to germinate caused by radiation and inability due to natural aging. The reactions of 8 seed types to radiation doses up to 1 million r are reported. Notable changes were found in the relative radiation sensitivity of the various seed types to medium doses. There is evidence indicating that the cytoplasm is responsible for these changes, and that consequently there is no parallelism between nucleus and plasma in regard to radiation sensitivity. Lakon's topographical germination test was used to examine plasma vitality in winter wheat after x-ray irradiation of up to 1.6 million r. The values obtained here agreed with those from the germination test. (auth)

22766

AN OXYGEN EFFECT ON THE EFFICIENCY OF INACTIVATION OF ESCHERICHIA COLI BY INCORPORATED RADIOPHOSPHORUS. James G. Van Dyke (Sloan-Kettering Inst. for Cancer Research, New York). Biochem. Biophys. Research Commun. 3, 190-5(1960) Aug.

Radioactive phosphorus incorporated into Escherichia coli or its phages was found to inactivate them with a constant efficiency. It was shown that inactivation was efficient only when the P^{32} was incorporated into DNA although DNA phosphorus was only 12% of the total amount. The effect of O_2 on this inactivation was investigated. The efficiency of inactivation was 0.12 under O_2 if 1.2×10^7 phosphorus atoms per nucleus was assumed. Under N_2 the sensitivity to P^{32} inactivation was reduced by a factor of 1.7. (M.C.G.)

22767

STUDIES ON RADIORESISTANCE. II. CHROMOSOME CONDITION AND RADIOSENSITIVITY OF A SUBLINE OF THE YOSHIDA SARCOMA INDUCED BY PRE-IRRADIATIONS. Koichi Kaneta (Sapporo Medical Coll.). Cytologia(Tokyo) 25, 112-18(1960) Mar. (In English)

The chromosome condition and radiosensitivity were investigated in a subline of the Yoshida sarcoma induced by pre-irradiation. The subline, characterized by increased radiosensitivity, was found to be of mixed diploid-hypotetraploid population. It has a modal chromosome number of 37 in earlier generations and 38 in latter generations in the diploid region, and of 70 to 73 in the tetraploid region. It was found that the polyploid cells showed a remarkable decrease in frequency during the serial transfers for 4 months without irradiation. There is a possibility that the rise of the subline was induced by frequently repeated heavy s irradiations with an integral dose of 87,480 r during 94 generations. Relationship between the chromosome number and radiosensitivity of the tumor is discussed. (auth)

22768

TISSUE HYPOXIA AS A MECHANISM OF THE ANTI-RADIO PROTECTION EFFECT OF ADRENALIN, HEROIN AND MORPHINE. M. M. Konstantinova and E. J. Graevskii (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 1427-30(1960) July 21. (In Russian)

The protective mechanism of adrenalin heroin, and morphine on white mice 12 to 18 weeks old, and weighing 18 to 23 g was analyzed in order to determine the protection action of neurotropical substances in relation to their ability to reduce oxygen in tissues. Parallel studies were made of the time factor influence. The results indicate that the investigated substances are capable of reducing the level of oxygen in tissue, and particularly in the spleen.

The reduction and restoration of the oxygen content correspond in general to the reduction and increase of mortality. Data confirm that the protective effects of adrenalin, heroin, and morphine are the result of their ability to produce hypoxia in radiosensitive organs. The hypoxia is induced by the adrenalin pressure effect and by morphine and heroin depression of respiratory centers. (R.V.J.)

22769

ENERGY LEVELS OF METASTABLE CONDITION OF BIOLOGICAL OBJECTS, AND THE MECHANISM UNDERLYING THE ACTION OF CERTAIN RADIOPROTECTORS. I. I. Sapezhinskii and N. M. Emanuel' (Inst. of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 1441-3(1960) July 21. (In Russian)

Gamma radiation effects on RNK and DNK albumen are analyzed and spectra of mouse liver and spleen homogenates and phosphorescence spectra of radioprotection substances at 77°K are developed. Tabulated data indicate close coincidence of the wave lengths corresponding to phosphorescence maximums for DNK, radioprotective substances, and gallic acid propylene ethers. It is postulated that the energy transition from the triplet level of DNK to the triplet level of protective substances results in reduced damage to DNK. Moreover, the molecules of the protective substance shift from the ground single level to the triplet. Studies of triplet levels of protective substances help to characterize the energy relation of these substances to the chemical components of biological structures. Preliminary experiments showed that the introduction of propylene gallate and isopropyl gallate reduces the life span of metastable states and dampens the phosphorescence of the albumen. (R.V.J.)

22770

THE FUNCTION OF NUCLEI IN THE DEVELOPMENT OF STRONGILOCENTROBUS DROBAHAENSIS INVESTIGATED BY THE METHOD OF RADIATION INACTIVATION. A. A. Neifakh (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 1458-61(1960) July 21. (In Russian)

An attempt was made to find the radiation dosage which completely inactivates nuclear functions without affecting the cytoplasmic functions. Comparisons were made of various stages of development after irradiation at various stages of embryo genesis in order to determine the controlling factor in development. Following artificial insemination, the eggs of Strongilocentrotus dröbachiensis were developed at 7 to 8°C. The irradiation was carried out with a $(Sr^{90} + Y^{90})$ β source to a dosage of 2000 r/min. The effects of various doses as various stages of development were plotted. Following irradiation with 30 kr and up the development is arrested at the same point, indicating complete inactivation of the controlling function. Considerable damage to the cytoplasma appears with a dose of 80 kr. The development of an embryo irradiated from the moment of insemination to the early blastula (14 hours of development $\approx$128 to 256 cells) does not depend on the moment of irradiation and the initial stages of development are normal. With irradiation during the median blastula period (14 to 13 hours), the development of the embryo was strongly affected. The development of the following period (30 to 42 hours) once again does not depend on the moment of irradiation, indicating that at later periods the nucleus does not perform specific controlling functions over development. (R.V.J.)

22771

EFFECTS OF X-IRRADIATION ON A NATURAL POPULATION OF THE DEER-MOUSE (PEROMYSCUS MANICULATUS). W. Frank Blair (Univ. of Texas, Austin). Ecology 39, 113-18(1958) Jan.

An attempt was made to upset the equilibrium between mutation pressure and selection pressure in a natural population of deer-mice (Peromyscus maniculatus) through irradiation of sexually mature males. A population was kept under observation by use of nest boxes. After one year of observation exposure of males to a 500 r gonadal dose of x ray was begun and continued for a five-year period. Certain aspects of population dynamics were highly pertinent to the conduct of the experiment and to the results obtained. Deer-mice are primarily winter breeders in the region studied. Relatively permanent mating pairs are formed. The average dispersal distance of the young is short. The life span is short and population turnover high, indicating high environmental pressure on the population. Reduction in litter size is attributed to radiation-induced lethal mutations. Maintenance of population numbers through four years of irradiation is attributed to high selection pressure, and a consequently high critical mutation rate in a species such as this. (auth)

22772

STUDIES ON SUSCEPTIBILITY TO INFECTION FOLLOWING IONIZING RADIATION. V. COMPARISON OF INTRAPERITONEAL AND INTRAVENOUS CHALLENGE AT INTERVALS FOLLOWING DIFFERENT DOSES OF X-RADIATION. C. Phillip Miller, Carolyn W. Hammond, and Sonia K. Anderle (Univ. of Chicago). J. Exptl. Med. 111, 773-84(1960) June 1.

Ten-week-old female CF-1 mice were subjected to a single total body exposure of x radiation in one of the following doses: 300, 400, and 500 r. At intervals thereafter, susceptibility to bacterial infection was determined by intraperitoneal challenge with graded inocula of Pseudomonas aeruginosa. Mice exposed to 400 or 500 r were also challenged by intravenous inoculation. The LD_{50} of the test microorganism in each challenge was estimated from the mortality data. Exposure to 300 r caused little increase in susceptibility to this experimental infection. A moderate increase on the 3rd day post-irradiation with return to normal on the 17th day was caused with a 400 r exposure. Leucocyte counts (geometric means) following this dose of radiation did not fall below 1200. A marked increase in susceptibility which lasted from the 3rd to 11th day (during which period the leucocyte counts were below 800) was caused by an exposure of 500 r. On the 20th day, susceptibility to infection was normal, although the geometric mean of leucocyte counts was only 2200. Comparison of mortalities resulting from equivalent inocula introduced by the two routes (intravenous and intraperitoneal) showed no difference in unirradiated mice. However, among mice irradiated with 400 or 500 r, higher mortalities resulted from intravenous inoculation. The difference was found to be due to the establishment of a small focus of infection at the site of intravenous injection as a result of leakage of a minute fraction of inoculum into the perivenous tissues of the tail. Bacterial multiplication occurred in such foci in irradiated (leucopenic) mice, but not in unirradiated mice, nor at the site of intraperitoneal inoculation even in irradiated mice. (auth)

22773

RESPONSE OF THE VERY EARLY MOUSE EMBRYO TO LOW LEVELS OF IONIZING RADIATIONS. Roberts Rugh and Erika Grupp (Columbia Univ., New York). J. Exptl. Zool. 141, 571-82(1959) Aug.

The mouse embryo from fertilization of the egg through the second or third cleavages (1.5 days) has been exposed to from 5 to 25 r x rays, and the gross consequences in terms of embryonic death and anomalies have been determined. Any x irradiation used to the 0.5 day embryo (prior to the first cleavage) was deleterious in terms of increased embryonic death. An exposure of 5 r caused 11% more deaths than among the controls, and 25 r caused 38% more deaths. X irradiation exencephalia occurred in a few instances following 15 or 20 r at 0.5 day and also at 1.5 days. Thus this cerebral anomaly can be caused by x irradiation even prior to the first cleavage. Mouse embryos exposed at these very early stages are often fragmented, or the entire egg is broken up into globules; one of these conditions may show the zygotic nucleus. Further development of such fragmented embryos is doubtful. The ovaries of x-irradiated pregnant mice show growing follicles with a higher preponderance of degenerating öocytes, pyknotic nuclei, congealed chromatin, and vacuolated nucleoli. On the basis of this study, the question is raised as to whether any extraneous or avoidable x irradiation of the human ovary should be allowed except where life is otherwise endangered. (auth)

22774

CHANGES IN RAT CARTILAGE MUCOPOLYSACCHARIDE WITH AGE AND RADIATION. B. Anderson and T. T. Odell, Jr. (Oak Ridge National Lab., Tenn.). J. Gerontol. 15, 249-52(1960) July.

A sulfated mucopolysaccharide containing equimolar quantities of uronic acid and hexosamine was obtained from rat costal cartilage by digestion with trypsin. Its concentration decreased with age. A second MPS not released by trypsin also contained equimolar quantities of uronic acid and hexosamine but incorporated little or no sulfate in a 24-hour period. The concentration of the latter MPS in cartilage remained relatively constant between ages 115 and 624 days. Whole-body x irradiation of young rats did not affect the concentration of either MPS in later life. (auth)

22775

STUDIES ON HEXOSAMINE AND COLLAGEN IN TISSUES OF RATS WHICH SURVIVED X-IRRADIATION. Harry Sobel, Sabit Gabay, and George Bonorris (Inst. for Medical Research, Cedars of Lebanon Hospital, Los Angeles and Univ. of Southern California, Los Angeles). J. Gerontol. 15, 253-7(1960) July.

The ratio of hexosamine to collagen was determined in skin, femur, sternum, lung, aorta, and vena cava of rats which had survived x-ray treatment administered in one dose from 15 to 18 months previously. It was observed that the ratios were lower than that of unirradiated animals of similar age if early phase mortality had exceeded 30%. This seemed to be due to a significant increase in collagen content. The hexosamine content seemed to be reduced but not significantly. These findings are consistent with the concept of accelerated aging in animals which survive irradiation damage. It is suggested that in part this phenomenon is due to increased fibrillogenesis following death or injury of parenchymal cells. (auth)

22776

EXENCEPHALIA FOLLOWING X-IRRADIATION OF THE PRE-IMPLANTATION MAMMALIAN EMBRYO. Roberts Rugh and Erika Grupp (Columbia Univ., New York). J. Neuropathol. Exptl. Neurol. 18, 468-81(1959) July.

If the mouse embryo is exposed to 50 r x rays at any time from fertilization of the egg through the 9th day of gestation, its probability of being killed or developing gross anomalies averages about 13%. If the exposure is to 200 r x rays, the probability is increased to 26%. The controls showed 5.7% death but no anomalies. The remaining litter mates that were similarly exposed, were questionably "normal" and generally stunted. The gross congenital anomaly known as exencephaly may result from x irradiation at any time from 0.5 to 9.0 days after conception. The idea of a critical period for this anomaly will have to be modified to include all stages of development prior to the differentiation of the nervous system. Exencephaly may be produced by damage to the newly fertilized egg before any cleavages or by damage to neuroblasts at 8.5 days. It is probable that the irradiated blastomers somehow interfere with the normal processes of gastrulation; this results in cephalic anomalies. Increased x irradiation did not increase the incidence of exencephaly as much as it increased the incidence of resorption. Exencephaly, therefore, is a central nervous system anomaly which does not kill in utero, and is intermediate between apparent normality of some and death of others. Prior to the first cleavage the fertilized egg is highly susceptible to irradiation insult, with 42% being resorbed after 50 r and 64% after 200 r. This represents very high reproductive waste, which is due solely to embryonic x irradiation. On the basis of the development of such an anomaly as exencephaly, it is believed that the stunted litter mates which appear to be normal may not function normally and that 50 r to any embryo prior to day 9.0 is permanently injurious, particularly to the central nervous system. The variations in the responses of litter mate embryos may be due to genetic differences between individuals, commonly called normal biological variability. The minimal exposure to x rays which may cause permanent neurological damage to the embryo or fetus has not been established. It is certainly less than 50 r x rays. 41 references. (auth)

22777

CLINICAL OBSERVATIONS IN RADIOIODINE THERAPY OF THYROTOXICOSIS. L. G. Alenina (Rostovon-Don Medical Inst. USSR). Med. Radiol. 6, No. 6, 17-20(1960) June. (In Russian)

Results are reported on the treatment of 458 patients suffering from thyrotoxicosis with radioiodine therapy. One group of 336 patients received additional treatment 3 months after the previous treatment. The total dose of radioiodine ranged from 2 to 14 mc. Full clinical recovery is reported for 64.4% of the cases. No effect was noted in 1.7% of the cases. (C.H.)

22778

CERTAIN PHYSICO-CHEMICAL AND CHEMICAL INDICES OF THE BLOOD IN CHRONIC ACTION OF LOW DOSES OF IONIZING RADIATION. L. E. Gorn (Leningrad Inst. of Industrial Hygiene and Occupational Deseases). Med. Radiol. 6, No. 6, 25-6(1960) June. (In Russian)

Results are reported from a study on 45 persons subjected during work to the protracted action of rontgen and gamma rays in doses exceeding the maximal permissible ones. It was found that the creatine, aromatic amino acids, and non-hemoglobin iron, as well as the redox potential of the serum, do not differ from the respective values in healthy subjects. (auth)

22779

BLOOD SERUM LACTIC DEHYDROGENASE FOLLOWING IRRADIATION. V. Volek and Z. Dinstbir. Med. Radiol. 6, No. 6, 39-42(1960) June. (In Russian)

The influence of irradiation on the activity of lactic dehydrogenase and the morphological picture of the blood was studied. It was found that lactic dehydrogenase activity decreases toward the 4th hour after irradiation; in 24 hours it reverts to normal or is higher than the initial values. The morphological changes of the blood intensify throughout the first week following the irradiation. The introduction of lactic dehydrogenase immediately after irradiation eliminates the activity of the enzyme, however, lymphopenia and neutropenia are influenced but insignificantly. The cause of low lactic dehydrogenase activity after irradiation is discussed. (auth)

22780

PARATYPHOID INFECTION EPIZOOTY IN THE PROGENY OF IRRADIATED RATS. O. M. Zemtsova and A. I. Osipovskiĭ (Sechenov, First Moscow Order of Lenin Inst. of Medicine, USSR). Med. Radiol. 6, No. 6, 47-51(1960) June. (In Russian)

Results are reported from studies of the course and outcome of a natural paratyphoid infection observed in the progeny (several generations) of non-irradiated and irradiated white rats. A reduced resistance was observed in the progeny of irradiated animals, as compared with the offspring of non-irradiated rats. A high mortality and dissemination of the organism with paratyphoid bacteria are the indices characterizing the reduced resistance. (auth)

22781

COMPARISON OF IODINE-124 AND IODINE-131 IN INHIBITION OF GOITROGENESIS IN THE RAT. I. Doniach (Postgraduate Medical School, London) and P. E. Francois. Nature 187, 704-5(1960) Aug. 20.

The inhibition of goitrogenesis in rat thyroids by iodine was studied for I^{124} and I^{131}, and the results were compared. The method used was to measure the goiters produced in response to a 10-day course of methylthiouracil consumed 3 to 4 months after a single iodine dose. The I^{124} used was contaminated with other iodine isotopes with the ratio $I^{123}/I^{124}/I^{126} = 1.0/2.0/0.17$. The average thyroid weight of the controls (no iodine or methylthiouracil) was 23.6 mg and that of those treated with methylthiouracil but no iodine was 48.9 mg; the results obtained with rats treated with both are expressed as percentage inhibition with 25-mg control thyroid and 50-mg goitrogen thyroid as basis. Both 29.5-μc I^{131} and 53-μc I^{124} showed 60% inhibition. Since it is calculated that 2.5-μc I^{124} will give the same average radiation dose to the gland as 1-μc I^{131}, I^{124} is slightly more effective than I^{131} for equivalent damage. (D.L.C.)

22782

THE PREVENTION OF X-RAY DEATH BY SELENIUM SALTS GIVEN AFTER IRRADIATION. Z. M. Holló and Sz. Zlatarov (University Medical School, Szeged). Naturwissenschaften 47, 328(1960). (In English)

Previously (Naturwissenschaften 47, 87(1960)) it was reported that the lethal effects of x radiation were prevented by sodium selenate. It was later determined that the selenate contained selenite with a selenite decomposition product. The effects of combined intraperitoneal and subcutaneous injections of selenate with 1.28% selenite on the x-ray-induced lethality in rats were studied. The selenate was dissolved in NaCl and then sterilized. All the rats receiving up to 4.6 mg/kg of the solution survived. All animals receiving pure selenate died, as did those that received the selenate-selenite solution that had been sterilized for too long a period. (J.S.R.)

22783

ACTION OF MALEIC HYDRAZIDE ON DORMANCY, CELL DIVISION, AND CELL EXPANSION. Alan H. Haber and Joe D. White (Oak Ridge National Lab., Tenn.). Plant Physiol. 35, 495-9(1960) July.

Maleic hydrazide (MH) can inhibit cell division in dormant lettuce seeds in which cell division occurs in the absence of growth by cell expansion. Concentrations of MH that inhibit normal growth of wheat seedlings by 85 to 90% have no effect on the growth of wheat from irradiated grain, which grows without any cell division. Thus MH affects mitosis in a system where gibberellic acid (GA) does not, and MH has no effect on cell expansion in a system where GA is active. When wheat is treated with a combination of MH and GA, the two chemicals apparently act independently on growth. All these findings suggest that the effect of MH on seedling growth can be largely or entirely attributed to an inhibition of cell division and not to any appreciable effort on cell expansion. MH and GA do not appear to give specific interactions on lettuce seed germination, thereby providing further evidence against the theory that MH and GA affect growth through common mechanisms. A number of similarities between effects of MH and of ionizing radiation are discussed, including the capacity to permit germination and limited seedling growth of wheat without cell division. (auth)

22784

THE EFFECTS OF X RAYS ON FERTILIZED EGG CELLS OF TRITON ALPESTRIS WITH SPECIAL EMPHASIS ON THE EFFECTS OF SMALL DOSES AND LESS DAMAGE. Theofried Peters (Heiligenberg-Institut, Heiligenberg/Baden, Ger.). Strahlentherapie 112, 525-42(1960) Aug. (In German)

A total of 4921 impregnated undivided germs of Triton alpestris were x-irradiated with doses of 2, 5, 10, 16, 20, 40, 50, 160, 200, 240, 320, and 6400 r and together with 1675 control germs hatched for 24 days. In all series the early damages were observed. According to earlier findings, there were not (following irradiation in this state) many more malformations than in the controls. An increased mortality was observed. This is, of statistical significance. For a study of the vitality of the normal larvas, (surviving normal appearing larvas of the control), 50-, 20-, and 10-r germs were exposed for several hours to an increased temperature. The increased mortality among the irradiated animals following this stress, which is of statistical significance for the 20- and 10- r germs, indicates a decreased vitality of these individuals. (auth)

22785

A NEW PROCEDURE FOR DETERMINING THE INSTANTANEOUS EFFECTS OF X RAYS. R. Schuppli and H. H. Wagener (Universitätsklinik, Basel). Strahlentherapie 112, 561-6(1960) Aug. (In German)

X rays of various dose and hardness cause a decrease of the frequency conducting power on the skin of anesthetized rabbits. Following repeated irradiations this reaction decreases considerably, and after a short time even high doses no longer cause this effect. (auth)

22786

MORPHOLOGY, THEORY, AND PROBLEMATICS OF THE LATE EFFECTS OF RADIATION IN THE CENTRAL NERVOUS SYSTEM. Wolfgang Dihlmann (Universität, Tübingen, Ger.). Strahlentherapie 112, 567-86(1960) Aug. (In German)

The late radiation damages of the central nervous system (CNS) are described histomorphologically. Besides changes of the vessels, the tigroid skeletation, described by Scholz and co-workers in animals, is also observed on human specimens. The late damages were observed below the generally accepted tolerance dose of the vessels and interstitial tissues, and there was no strict relation to the usual tumor doses. Therefore most of the late damages, in analogy with late damages of other organs, are considered to be combination or summation damages. This means that there is no tumor dose for the treatment of gliomas, which could not possibly cause a late damage. This conception can be partially set over the interpretations of other authors or partially substitute opinions about more complicated causes. The plasmatic infiltration is not specific for brain substance. Its appearance and the proof is favored in the brain due to the anatomical and physiological specialties of the CNS. Therefore, the findings of the late radiation damage of the CNS can easily be morphologically and pathogenetically integrated into our knowledge of localized late radiation damage, even if it takes a more malignant course, due to the peculiarity of the brain substance. (auth)

22787

EFFECTS OF X RAYS ON THE PERMEABILITY OF CAPILLARIES (STUDY OF THE MESENTERY OF RANA ESCULENTA). Antonio Cali and Vincenzo Verga (Università, Naples). Strahlentherapie 112, 604-7(1960) Aug. (In German)

The mesentery of living frogs (Rana esculenta) was x irradiated with different doses. Evan's blue was injected into the ventricle of the heart for the examination of possible changes of the permeability caused by x rays. The experiments showed that high doses of x rays increase the permeability of capillaries. This is caused by depolymerization of the basic substance that holds the endothelium together. The different microscopic observations during x irradiation were documented by cinematography. (auth)

22788

CHANGES IN THE LIVER TISSUE OF RATS AND ESPECIALLY THE ARGENTOPHILE RETICULUM AFTER DIRECT FRACTIONATED X IRRADIATION OF THE LIVER. Vincenzo Verga and Antonio Cali (Università, Naples). Strahlentherapie 112, 608-12(1960) Aug. (In German)

The liver of rats was irradiated with fractionated doses (50 r per day). At different periods of time following the onset of irradiation two animals were killed at the same time. The observations proved that this irradiation causes a proliferation of the reticular parts and alterations of the argentophile fibrils if the total dose of x rays is high (9800 r). (auth)

22789

EFFECTS OF BETA RAYS FROM P^{32} ON TRICHINELLA SPIRALIS. Werner Hartung and Hermann Becht (Universität, Giessen, Ger.). Strahlentherapie 112, 613-20(1960) Aug. (In German)

If trichinas, isolated from muscles by peptic digestion, are exposed to contact irradiation of 4000 rad in a P^{32}-containing medium, sterilization occurs. Parasites irradiated with 6000 rad can live for five days in the intestine, but they show marked inhibition of growth. This dose is the same as reported by other authors and does not conform with the γ intensity reported by them. The incorporation of radioactivity is up to a dose of 4000 rad minimal, but it increases later, however, possibly due to greater permeability of the cell membranes. The immunization power of trichinas, that are sterilized by means of beta rays is not impaired. The incorporated radioactivity does not seem to have undesired effects on the immunization mechanism of the host. (auth)

22790

CLINICAL AND EXPERIMENTAL ANIMAL STUDIES OF THE EFFECTS OF LIVER HYDROLYSATES ON RADIO-INDUCED REACTIONS. Bernd Brüdigam and Heribert Braun (Medizinische Universitätsklinik, Würzburg, Ger.). Strahlentherapie 112, 621-28(1960) Aug.

Based on clinical studies and comparing animal experiments, a favorable effect of liver hydrolysates (Prohepar) on the changes occurring during the application of therapeutic radiation doses was observed. Besides the decrease or prevention of the subjective general complaints, the changes of the serum albumine composition occurring during irradiation could be decreased by the administration of Prohepar. An effect on the behavior of the serum enzyme activity, which is usually increased moderately during irradiations, was not observed. (auth)

22791

RELEASE OF REFLEXES IN SNAILS BY X AND ALPHA RAYS. Willi Born (Universitäts-Hautklinik, Freiburg i B.). Strahlentherapie 112, 634-6(1960) Aug. (In German)

The contraction of the mantle cavity of native pulmonate snails as a reaction of local influence of x- and α-rays is described as a new type reflex and is compared with the recently announced tentacle reflex of snails. (auth)

22792

EFFECTS OF X-IRRADIATION ON A NATURAL POPULATION OF THE WOOD-MOUSE (PEROMYSCUS LEUCOPUS). W. Frank Blair and T. E. Kennerly, Jr. (Univ. of Texas, Austin). Texas J. Sci. 11, 137-49(1959) June.

An attempt was made to upset the equilibrium between selection pressure and mutation pressure through irradiation of sexually mature male woodmice (Peromyscus leucopus). A population was studied through the use of nest boxes. Following two years of observation gonadal X-ray dosage of 700 r was commenced and continued for a five-year period. Population dynamics of this species were pertinent to the methods used and the results obtained and agreed generally with studies of other species of this genus. Dispersal distance in short and replenishment of the study population through immigration is regarded as slight. High population turnover and short life span indicate high environmental pressure. Mated pairs are relatively permanent during the breeding season which occurs in winter in the region studied. The wood-mice indicated a preference for tree boxes over ground boxes. Principal irradiation effects were reduction in litter size and reduction in population numbers. Both are attributed to radiation-induced lethal mutations. The critical mutation rate is thought to have been approached. (auth)

22793

CYSTEINE PROTECTION AND OXYGEN EFFECTS ON SUSPENDED T PHAGES UNDER X IRRADIATION. G. Hotz and A. Müller (Kernforschungszentrum, Karlsruhe, Ger.). Z. Naturforsch. 15b, 450-2(1960) July. (In German)

Coliphages of the strains T1, T2, and T7 suspended in broth were inactivated by x rays. Under these conditions the phages should be protected from indirect effects. The action of cysteine and removal of oxygen were investigated. With T1, T2, and T7 hyperprotection by cysteine was found, which could not be substituted by anoxia. None of these phages showed a marked decrease in radiation sensitivity on removal of oxygen, whereas hyperprotection was strongly affected by air with T1 and T7 but not with T2. Tentative explanations for the differences between T1 and T2 were given. (auth)

22794

THE EFFECT OF 2, 4-DINITROPHENOL ON THE RESPIRATION IN KIDNEY SECTIONS WHICH IS INCREASED BY X RADIATION. H. Breuer, H. K. Parchwitz, and Ilse Pechthold (Chirurgische Universitätsklinik, Bonn). Z. Naturforsch. 15b, 469-70(1960) July. (In German)

The respiration of a kidney cortex section was tested in the range from 1×10^2 to 1×10^6 r x radiation with and without the addition of 2,4-dinitrophenol. Guinea pigs were used as the experimental animals. The results were graphed. The oxygen uptake in the irradiation range from 1×10^2 to 5×10^4 r did not vary from that observed in unirradiated sections. Above 10^5 r a sharp increase of the respiration was observed with increasing doses. The respiration rise caused by DNP was unaffected by irradiation up to 10^4 r. With increasing dose the oxygen uptake was reduced. The radioinduced respiration increase was established at approximately the same dose as the radioinduced arrest of the respiration increased by DNP. The possible mechanism was discussed. (J.S.R.)

Radiation Sickness

22795 A/AC.82/G/R.230
Ceskoslovenská Akademie Veď. Biofyzikdlne Ústav, Brno.
THE ROLE OF DEOXIRIBONUCLEOTIDES IN IRRADIATION SICKNESS. Preliminary Report. J. Soška, Vl. Drášil, and Zd. Karpfel. [1956]. 5p.

Reaction mechanisms involved in the therapeutic effect of injected hematopoietic cells in radiation sickness are discussed. It is suggested that a humoral factor is produced by some cellular component of the normal hematopoietic tissue which controls mitoses and the synthesis of desoxyribonucleic acid in other cells. Irradiation inhibits the production of this factor and the subsequent inhibition of synthesis of desoxyribonucleic acid and of mitoses causes the syndrome of radiation sickness to develop. (C.H.)

22796 TT-900
ALTERATIONS IN THE GLYCOGEN CONTENT OF ORGANS OF THE RAT IN ACUTE RADIATION SICKNESS. (Izmeneniia Soderzhaniia Glikogena v Organakh Kryspri Ostroi Luchevoi Bolezni Tiazheloi Stepeni). D. A. Golubentsev. Translated by G. Belkov (National Research Council of Canada) from Voprosy Med. Khim. 5, 107-11 (1959). 11p. JCL.

General x-ray irradiation of rats with doses of 700 to 900 r does not bring about essential changes in the content of glycogen in the liver, diaphragm, skeletal and heart muscles, spleen, testes, lungs, and kidneys during the first hours and days after exposure. During the climax of the sickness in the majority of animals a substantial decrease in glycogen was observed in the liver and heart muscle with absence of changes in the skeletal muscles, lungs, kidneys, spleen and testes. During clinical convalescence the content of glycogen in the heart muscle, diaphragm, and liver remained low in animals with signs of anemia. (auth)

22797
ATTEMPTS AT PROTECTION OF MICE AGAINST IONIZING RADIATION BY EXOGENOUS CATALASE. Robert N. Feinstein (Argonne National Lab., Ill.). Atompraxis 6, 205-7(1960) June. (In English)

Beef or mouse liver catalase administered intravenously to mice apparently is not absorbed by the erythrocytes or the cells of the liver, spleen, or intestine. Erratic results were shown by kidney. Increases in the catalase activity of spleen and intestine were attributed to the catalase increment of the blood plasma and, in the case of the intestine, to its excretory function. The administration of mouse or beef liver catalase shortly before or after whole-body x irradiation of mice with 750 or 800 r was without effect on percentage survival or survival time. (auth)

22798
PROTECTION OF GUINEA PIGS AGAINST RADIATION MORTALITY BY ONE-YEAR-OLD MOUSE SPLEEN EXTRACT. F. Ellinger (Naval Medical Research Inst., Bethesda, Md.). Atompraxis 6, 208-9(1960) June. (In English)

Preliminary observations concerning a protective effect against radiation death of heterologous cell-free total spleen extracts, if administered after irradiation, are confirmed. In addition, it is demonstrated that the active principle of spleen extracts remains stable within these crude extracts for a period of one year, if the lyophilized extract is stored in a refrigerator. (auth)

22799
HEMATOLOGY OF THE ACUTE RADIATION SYNDROME. Theodor M. Fliedner (Universität, Heidelberg, Ger.). Strahlentherapie 112, 543-60(1960) Aug. (In German)

The reports about the findings on persons, who were exposed to different doses of ionizing radiation during radiation accidents make it possible to give a better analysis of the "hematologic type" of the acute radiation syndrome in relation to diagnosis, course of the disease, and therapy. Whereas the blood cell counts during the first 48-hr period do not permit unequivocal conclusions on the radiation dose and the course of the disease, the bone marrow aspiration gives information about the extent of the damage visible on the disorder of the cells and mitoses. The clinical course demonstrates that the main danger of the "hematologic type" is from the infections due to granulocytopenia and hemorrhage due to thrombopenia in the 4th and 5th week. Since the spontaneous power for regeneration of the bone marrow is remarkable in the lethal range and since after only 21 days following the accident an increase of the mitosis rate was observed, the type of therapy should depend on the spontaneous regeneration or the absence of regeneration. In case of spontaneous recovery the therapy of choice is symptomatic treatment of the infections with antibiotics and treatment of the hemorrhages with transfusions of thrombocytes and fresh blood. Only if spontaneous regeneration of the bone marrow does not occur or can not be expected, the transfusion of functioning hemopoietic tissue should be considered. Up to now there is no evidence for the success of bone marrow transfusions in the treatment of patients who suffered a radiation accident. (auth)

CHEMISTRY

General and Miscellaneous

22800 AD-235207
Duke Univ., Durham, N. C.
SYMPOSIUM PROCEEDINGS [ON] THE CHEMISTRY OF SOLID SURFACES, HELD AT DUKE UNIVERSITY, DURHAM, N. C., MARCH 26-27, 1958. 151p.

The effects of lateral interaction and surface heterogeneity are considered in an attempt to account for differential heats of adsorption of gases as incomplete monolayers on solids. The thermodynamic equilibrium of electrical charges at the interface of a dielectric in contact with another material is discussed. The behavior of macromolecules at solid or liquid interfaces and the adhesion and orientation of monolayers are discussed. The effect of lubricants on metal transfer in the operation of drawing metals through dies was studied by tracer techniques. Mechanisms of wear friction and metal transfer are discussed. The chemical and physical properties of films of organic compounds on high- and low-energy surfaces are considered. The chemisorption of gases on nickel and adsorption of polar organic molecules on active metal surfaces are discussed. (C.J.G.)

22801 NAA-SR-5153

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

A VIBRATIONAL POTENTIAL FUNCTION FOR SYMMETRICALLY SUBSTITUTED BIPHENYLS. R. H. Shudde and G. W. Lehman. Aug. 30, 1960. 19p. Contract AT-11-1-GEN-8. OTS.

A general valence force potential function is derived which contains the dihedral angle and symmetrically equivalent atomic masses, bond angles, and bond lengths as parameters enabling one to study molecular vibrations in symmetrically substituted biphenyl molecules having D_2 symmetry. The 66 symmetry coordinates are expressed in terms of the cartesian components of a single set of seven symmetry vectors, P_j, and the characters, χ_q, of the D_2 symmetry operators. These symmetry vectors are directly related to the seven distinct groups of symmetrically equivalent atoms in biphenyl. It is similarly shown that the atom displacements can be written in terms of this set of P_j's. The molecular vibrations are described in terms of seven bond stretching, ten in-plane and four out-of-plane bond bending, and four torsional modes. The bond length and angle deformations associated with these twenty-five types of vibrations are likewise expressed in terms of this set of P_j's and the characters, χ_q's. Consequently, a single potential function suffices for the four irreducible representations of the D_2 symmetry group. (auth)

22802 NP-8781

Monsanto Chemical Co., Everett, Mass.

RESEARCH ON SYNTHESIS OF 1000°F. STABLE BASE FLUIDS. Quarterly Progress Report for March 1, 1960 to April 30, 1960. J. W. Dale, G. J. O'Neill, P. G. Scheurer, and G. R. Wilson. May 15, 1960. 23p. Project 0(3-8128). Contract AF33(616)-6851.

Synthesis of thermally stable (1000°F) fluids was studied with emphasis on the fluorine field, especially polymeric perfluoroaromatic derivatives. Three approaches are being made for the syntheses of such polymers: (1) stepwise synthesis from tetra- and penta-fluorophenyl derivatives using the Schiemann reaction as much as possible, (2) CoF_3 fluorination, and (3) electrochemical fluorination. In (1), attempts and suggestions for improving the synthesis of sym-tetrafluorobenzene, pentafluorobenzene, tetrafluorohydroquinone, and other intermediates described. In (2), it is hoped thereby to fluorinate polyphenyl derivatives, directly. For (3), a Simons cell containing HF was constructed, and trimesic acid will be one of the first compounds to be electrolyzed in this cell. Non-fluorine-containing compounds were also investigated; they include benzophenone, fluorenone, 2-phenyl-1,3,2-benzodiazoborole, 10-hydroxy-9-oxa-boraanthracene, and several organosilicon compounds. (D.L.C.)

22803 NP-8861

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

DIE AUFNAHME DER ATHYLENDIAMINTETRAESSIGSÄUREKOMPLEXE VON ZINK, CADMIUM, ZIRKON UND NIOB DURCH ANIONENUSTAUSCHER. (The Uptake of Ethylenediaminetetraacetic Acid Complexes of Zinc, Cadmium, Zirconium, and Niobium by Ion Exchangers). Report No. 147/V. M. Wald. Apr. 1960. 21p.

The radioactive tracers Zn^{65}, Cd^{115m}, Zr^{95}, and Nb^{95} were used to study the exchangeability of EDTA complexes of these elements on a column of the strongly basic resin Dowex 1 × 4. The measurement of the distribution coefficients between nitrate-bearing exchangers and EDTA-containing nitrate solution or between EDTA-bearing exchanger and EDTA solution made possible some conclusions about the composition of the complex which was selected for the exchange process. Zinc forms a divalent complex in the pH range studied (3.0 to 8.8) which is taken up by the exchanger stronger than the pB complex. On nitrate-loaded exchange columns the elution rate is strongly influenced by the EDTA content of the elution solution when the ratio of nitrate to H_2Y^{2-} falls below 100. The cadmium is taken up by the nitrate-loaded exchanger in the pH region 5.0 to 10.0 as a divalent complex, but weaker than the Zn complex. On EDTA-loaded exchange columns the uptake process for Zn and Cd is specific for their divalent complexes, and Cd is taken up considerably weaker than Zn. Zirconium is taken up in the pH range 5.0 to 7.5 as the divalent zirconyl complex, as determined from the composition $ZrH_3Y_2^-$ for the adsorbate. Niobium is retained on the exchange column as a radiocolloid. The comparison of uptake of ZnY^{2-}, PbY^{2-}, and CdY^{2-} complexes leads to the conclusion that the value of the complex formation constant just like the charge number does not represent the final factor for strength of adsorption. The possibility of radiochemical separation of Zn, Cd, Pb, and Bi. and of Zr and Nb is demonstrated. (tr-auth)

22804 OOR-007.4

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

FLUOROCARBON NF COMPOUNDS. Quarterly Technical Report No. 4 [for] April 1, 1960 through June 30, 1960. J. A. Young and R. D. Dresdner. 13p. Contract DA-01-009-ORD-772.

Nuclear magnetic resonance data are given for the compound previously obtained by CsF-catalyzed addition of c-$C_5F_{10}NF$ to $CF_3CF = CF_2$. The product, obtained in good yield, was identified as perfluoro-n-methylpiperidine. Formation of N-F compounds by cleavage of acyl groups from nitrogen was extended to perfluorodimethylacetamide. (For preceding period see NP-8638.) (auth)

22805 TID-6242

Pittsburgh. Univ.

STUDIES OF COORDINATION COMPOUNDS CONTAINING OLEFIN AND OLEFIN-LIKE LIGANDS. Progress Report from August 1, 1959 to July 31, 1960. July 1960. Bodie E. Douglas. 12p. Contract AT(30-1)-2274. OTS.

Evidence was obtained for the existence of the species $Cu(pyridine)_2^+$ and $Cu(pyridine)_3^+$, and formation constants were calculated. Estimates of the formation constants for $Cu(pyridine)_3^{++}$ and $Cu(pyridine)_4^{++}$ are given. Two one-electron reduction waves were obtained for Cu(II) in the presence of 2-picoline from which the species $Cu(picoline)_2^+$ was established. (C.J.G.)

22806 TID-6268

[Los Alamos Scientific Lab.,] N. Mex.

LABORATORY STUDIES PERTAINING TO THE TREATMENT OF TNT WASTES. Everett R. Mathews, Elgin H. Rex, Robert L. Taylor, and John F. Newell. [195?]. 19p. OTS.

Laboratory studies were made on the treatment and disposal of TNT wastes for the purpose of determining the most effective process for waste treatment at several explosives loading plants. Industrial wastes from these plants consist of used waters from operations where machining and casting of explosives are carried out. The important constituents of these wastes are alpha-TNT, RDX, barium nitrate, and suspended solids. Final disposal of the wastes after treatment will usually be to small streams where a large ratio of dilution water is not available at all times. (W.L.H.)

22807 TID-6277
Ionics, Inc., Cambridge, Mass.
PROGRESS REPORT [ON CHEMISTRY] FOR PERIOD COVERING MAY 16—JULY 15, 1960. July 15, 1960. 22p. Contract AT(30-1)-2470. OTS.

Work was continued on the evaluation and development of the amine extraction procedure for Th. A procedure is presented for determining Ra^{223} in solutions containing mixed radium nuclides. (For preceding period see TID-5893.) (W.L.H.)

22808 TID-6344
Illinois. Univ., Urbana. Noyes Lab. of Chemistry.
HIGH CONCENTRATION-RATIO TECHNIQUE: ISOTOPE FRACTIONATION AT THE METHYL CARBON IN THE REACTION OF CYANIDE ION AND METHYL IODIDE. ISOTOPE EFFECT UNDER CONDITIONS OF EQUAL REAGENT CONCENTRATIONS. K. R. Lynn and Peter E. Yankwich. 1960. 20p. [Project No. 4. Contract AT (11-1)-67]. OTS.

The C^{13} isotope effect for the methyl carbon atom was measured in the cyanization of methyl iodide in water solution between 11.4 and 58.0°. As a check on these results and those previously reported for isotope fractionation at the cyanide carbon atom, experiments were carried out also in which the reagents were present at equal concentrations instead of one being in large excess; the check experiments yield data of considerably higher quality than either set obtained under high concentration-ratio conditions. There is general agreement among the three sets of results, but it is not sufficiently close to permit detailed speculations concerning the nature of the reaction coordinate motion in terms of simple models. The methyl carbon isotope effect in the cyanization is much larger than that observed in the related hydrolysis, a fact which cannot be explained unless account is taken of the details of activation changes in C-H bonding. (auth)

22809 UCRL-9213
California. Univ., Berkeley. Lawrence Radiation Lab.
FRACTIONAL CRYSTALLIZATION FROM MELTS (thesis). William R. Wilcox. June 1960. 239p. Contract W-7405-eng-48. OTS.

Studies of the separation process known as zone melting were made on 10% by weight (10%w) mixtures of β-naphthol and of benzoic acid in naphthalene. The solid mixtures were enclosed in 5 to 10 mm glass tubes and pulled through a stationary heater, which generated a liquid zone. The separation increased as the zone travel rate decreased, as the size of the tube increased, and as the difference in liquid density between the bulk solid and the freezing interface increased. It was also found that, for vertical tubes, the separation was much greater when the fluid of lower density (between the bulk zone and the freezing interface) was on the bottom than when it was on the top. Insertion of an axial tube or rod of metal or glass into the zone also increased the separation. A correlation was developed which enables estimation of the separation for various situations in zone melting. Equations and principles were developed which enable estimation of the thermal requirements for zone melting and a theoretical study of pure diffusional mass transfer in zone melting was also made. A general expression for concentration profiles was derived for materials with a constant distribution coefficient and a method for the rapid estimation of these concentration profiles was developed. Numerical results for eutectic-forming systems were obtained, and summarized in an analytical approximation. Economic calculations are included for a separation in the multistaged semicontinuous zone refiner known as a zone-void refiner. Exploratory experiments were made on a cooled-drum apparatus (modified drum-flaker), using NaCl-water as a system. These indicated that this equipment might be useful for large scale industrial separations, although further research and development are needed. (auth)

22810 WADC-TR-57-126(Pt.IV)
American Potash and Chemical Corp., Whittier, Calif.
PHOSPHINOBORINE POLYMERS. [Period covered]: January 6, 1959 through January 5, 1960. Ross I. Wagner. Mar. 1960. 130p. Project 1428. Contract AF33(616)-5435.

Linear dimethyl-, methylethyl-, and diethylphosphinoborine polymers were prepared. N-Methylpiperazine, when used as an end-group for linear dimethylphosphinoborine polymers, provided a fair yield of product which, except for a large melting range, resembled polymers terminated with other end-groups. Triethylenediamine markedly reduced the rate of dimethylphosphine borine pyrolysis and failed to yield a linear polymeric product. Qualitative solubility data were obtained for the linear methylethyl- and diethylphosphinoborine derivatives. Attempts to prepare linear phosphinoborine polymers either by pyrolysis of trimethylphosphine trichloroborine or dimethylphosphinoborine trimer with triethylamine or by alkylation of methylphosphinodimethylborine polymer were unsuccessful. Linear methylethylphosphinoborine polymer was only partially chlorinated on treatment with methyl chloride—aluminum chloride. An attempt to open the dimethylphosphinoborine trimer ring by heating with triethylenediamine resulted in a polymer formed by opening the ring structure of the diamine. Dimethylphosphinoborine trimer was prepared in good yield from dimethylphosphonium chloride and lithium borohydride and in low yield by dehydrohalogenation of dimethylphosphine chloroborine. Dehydrohalogenation of dimethylphosphine diethylchloroborine and dimethylphosphine trichloroborine failed to give cyclic trimeric products, but the latter appeared to yield low-molecular-weight linear phosphinoborine polymers. The stoichiometry of the fluorination of dimethylphosphinoborine trimer was established experimentally, but no success was achieved in attempts to cyanogenate the trimer. An x-ray diffraction study of the dimethylphosphinoborine—methylphosphinoborine pentamer indicated the crystals to be of complex structure. Dimethylphosphinodichloroborine trimer appeared to be less thermally stable than the parent compound. A secondary phosphine intermediate was synthesized; nuclear magnetic resonance spectra proved it to be cycloethylenephosphine. N-Dimethyl-B-trimethylborazene was synthesized both by dehydrohalogenation of a mixture of the methyldibromoborine adducts of methylamine and ammonia and by pyrolysis of a mixture of the trimethylborine adducts of methylamine and ammonia. The isomeric N-trimethyl-B-dimethylborazene was prepared by reaction of N-trimethylborazene with a deficiency of methylmagnesium bromide. The attempt to prepare decamethylbiborazyl by pyrolytic dehydrogenation of the two isomeric pentamethylborazenes resulted in formation of by-product methane and a polymeric borazene derivative. The psuedoaromatic 8-bora-7,9-diazaro-*peri*-naphthene was prepared. Dimethyl- and diphenylthiosiloxane polymers were prepared by reaction of the corresponding dichlorosilanes with hydrogen sulfide. In the presence of trimethylchlorosilane, the preparation of diphenylthiosiloxane polymers resulted in a high yield of a single crystalline solid, presumably the trimer or dimer. [For preceding period see WADC-TR-57-126(Pt.III).] (auth)

22811 WADC-TR-59-61(Pt. II)

General Electric Co. Research Lab., Schenectady, N. Y. RESEARCH ON POLYMERIC BONDING SYSTEMS AND THEIR DIELECTRIC BEHAVIOR. Period covered: March 1959 to March 1960. R. P. Anderson and M. M. Sprung. June 1, 1960. 44p. Project No. 7021. Contract AF33(616)-5535.

Further work on the formation of borosiloxane polymers, particularly by the reaction between an acetoxysilane and an alkoxyborane or by the reaction between an alkoxysilane and an acetoxyborane, is described. A variety of low polymers, bearing different substituents on silicon and on boron, were prepared. Several nonlinear, hydrocarbon-insoluble fractions were isolated, and it was shown that disproportionation sometimes occurred. Some dephenylation of a phenylborane moiety almost always occurred when high temperatures were employed. In the reaction of an aminoalkylalkoxysilane with boron acetate, the amino substituent entered the reaction by elimination of acetic acid. A primary amine underwent group interchange with an acetoxy silane. Dichloro-p-(dimethylaminophenyl)methylsilane and dichloro-p-(dimethylaminophenyl)phenylsilane were prepared and converted to the corresponding diacetoxysilanes. Dichloro-p-(dimethylaminophenyl)phenylsilane was hydrolyzed nearly quantitatively to the corresponding diol, and the diol was reacted with benzeneboronic acid to produce a nitrogen-substituted borosiloxane. The equilibration of cyclic siloxanes and boroxanes was studied briefly. Dephenylation was negligible at reasonable temperatures, but oxidation was still possible. Thermal equilibration, with the boron component acting as an autocatalyst, was a slow process but gave better results than base catalyzed equilibration. Several amine complexes of tributyl borate were prepared. Crystalline complexes of triphenylboroxole and amines were not obtained, but interesting, stable "adducts" were obtained with several polyethylene amines. A similar adduct was obtained from poly(triphenylborosiloxane) and tetraethylene pentamine. Several aminoalkyl borates were prepared and their properties compared to simple alkyl borates. These data were then extended to linear polymers formed from alkyl borates with diols or aminodiols; and to crosslinked polymers formed from alkyl borates with diols, oxadiols, or aminodiols. It was observed that whenever five-membered rings could be formed through B–N dative bonding, this reaction route was favored almost exclusively over polymer formation. (auth)

22812 WADC-TR-59-436

Polacoat Inc., Blue Ash, Ohio. PHOTOTROPY: A LITERATURE REVIEW. Glenn H. Brown. Dec. 1959. 61p. Project 7165. Contract AF33(616)-5469. (AD-234009). OTS.

A review was made of phototropic-phenomenon literature and limited to articles referenced in Chemisches Zentralblatt from 1880 to 1910 and in Chemical Abstracts from 1907 to 1955. Some books dealing with photochemistry were also reviewed. The review is divided into five sections: an introduction, a listing of phototropic solids and solutions, properties of solutions exhibiting phototropy, properties of solids exhibiting phototropy, and the theory of phototropy. (M.C.G.)

22813 WT-1198

Office of Civil and Defense Mobilization, Battle Creek, Mich. THERMAL IGNITION AND RESPONSE OF MATERIALS. Kyle P. Laughlin. Dec. 1957. 56p. Project 31.5 [of] OPERATION TEAPOT. OTS.

Results are tabulated from tests on the response of various materials to the thermal radiation from atomic explosions. The tests included the effects of thermal radiation on sound-wood surfaces and treated-timber piling, the reduction of thermal energy by passage through windows covered with various materials, the response of 100 types of fabrics of various colors and chemistries, the effects of thermal radiation on standard oxyacetylene units and flammable-liquid drums, and the effects of thermal radiation on 200 samples of plastic materials and plastic articles at various distances from ground zero. (C.H.)

22814 Y-1308

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. PREPARATION OF URANOUS OXALATE. L. R. Phillips, C. D. Hardin, W. L. Harper, and C. D. Montgomery. July 7, 1959. 13p. Contract W-7405-eng-26. OTS.

A method for the preparation of $U(C_2O_4)_2$ from a $UO_2(HCOO)_2$ solution is described. The $UO_2(HCOO)_2$ solution was electrolytically reduced in a glass cell. $U(C_2O_4)_2$ was precipitated by the addition of a saturated $(COOH)_2$ solution. (C.J.G.)

22815 AEC-tr-4196

IMPROVEMENT OF POLAROGRAPHIC DROPPING CAPILLARIES BY MEANS OF SILICONING. M. von Stackelberg and V. Toome. Translated by H. P. Raaen (Oak Ridge National Lab.) from Leybold polarograph. Ber. 1, No. 4, 55-8(1953). 6p. JCL.

An improvement for polarographic glass dropping capillaries is described. A silicone coating is used to cover the surfaces rendering the capillary water repellent and thereby preventing the infiltration and adherence of solution between the capillary wall and mercury. Imprisonment of crystals is also prevented. (J.R.D.)

22816 JPRS-2652

THE EFFECT OF MOLECULAR STRUCTURE ON THE VELOCITY OF THE IONIC AND ATOMIC REACTIONS OF ISOTOPE EXCHANGE. I. THE EFFECT OF LENGTHENING THE CARBON CHAIN OF THE ALKYL RADICAL ON THE RATE OF ISOTOPE EXCHANGE OF AN ALKYL HALIDE WITH HALIDE IONS. M. B. Neyman, Yu. M. Shapovalov, and V. B. Miller. Translated from Zhur. Fiz. Khim. 28, 1243-56(1954). 29p. OTS.

Results of experiments are presented in which the mechanism and velocity of isotope exchange are represented by $RX + X^{*-} \rightarrow RX^* + X^-$, where x is bromine or iodine and R is CH_3, C_2H_5, or C_3H_7 radical of normal structure. It was found that the isotopic exchange of saturated polyhalide derivatives of alphatic compounds with sodium halide in alcohol operates according to a molecular-ion mechanism connected with inverse configuration. Lengthening the carbon chain in the R radical results in retardation of the isotopic exchange between alkylbromides and alkyliodides with halide ions. The greatest effect is observed during change from CH_3 to C_2H_5 radicals. (J.R.D.)

22817 JPRS-2764

THE INFLUENCE OF THE THERMODYNAMIC ISOTOPE EFFECT ON THE KINETICS OF EXCHANGE REACTIONS. Ya. Varshavskiĭ (Varshavskiy). Translated from Problémy Kinetiki i Kataliza, Akad. Nauk S.S.S.R., No. 9, 363-8(1957). 9p. OTS.

The influence of the thermodynamic isotope effect on the kinetics of exchange reactions was investigated in the case of hydrogen and other relatively light elements. (C.J.G.)

22818

PREPARATION OF 2,5-DIPHENYLOXAZOLE (ORGANIC SCINTILLATOR IN SOLUTION). A. Balaban and P. Frangopol. Acad. rep. populare Romîne, Studii cercetări chim. 6, 427-32(1958). (Translated from Referat. Zhur. Khim. No. 20, 1959, abstract No. 71511).

The effects of various quantities of $SOCl_2$ on the formation of 2,5-diphenyloxazole, prepared from C_6H_5CHO, $C_6H_5CH(OH)CN$, and gaseous HCl in ether were studied. The highest yield, 31%, was obtained when 0.5 mole of $SOCl_2$ was used per mole of C_6H_5CHO and $C_6H_5CHOHCN$, and HCl passed through the mixture for 2 to 3 hours.

22819

ALKALIMETRIC TITRATION OF BORON AFTER MERCURY CATHODE AND HYDROXIDE SEPARATIONS OF INTERFERENCES. James C. Neace (Martin Co., Baltimore). Chemist Analyst 49, 71-2(1960) Sept.

In the determination of boron, the mercury cathode was used to remove various interfering cations from borate solutions. It was found that the remaining interferences, including aluminum and uranium, could be removed by a simple sodium hydroxide precipitation. The borate was then titrated alkalimetrically in the resulting filtrate after pH adjustment and addition of mannitol. (M.C.G.)

22820

OBSERVATIONS ON SOME RUTHENIUM CHLOROCOMPLEXES. S. Forcheri, V. Lungagnani, S. Martini, and G. Scibona (Comitato Nazionale per le Ricerche Nucleari, Ispra, Italy). Energia nucleare (Milan) 7, 537-46(1960) Aug. (In English)

The preparation of K_2RuCl_6 was described, and the results of preliminary observations carried out by means of polarography, chromatography, electrochromatography, and spectrophotometry on the solution behavior of this salt in aqueous medium were given. A time dependence of the behavior in solution depending on the hydrogen ion and chloride ion concentration was observed. (auth)

22821

ARYLBORONIC ACIDS. VI. AMINOBORONIC ANHYDRIDES AND A NEW HETEROCYCLE CONTAINING BORON. Richard T. Hawkins and H. R. Snyder (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 82, 3863-6(1960) Aug. 5.

Three o-(dialkylaminomethyl)-benzeneboronic anhydrides are shown to be trimeric. Hydration of the corresponding anhydrides, which do not form complexes with pyridine, provides o-(N-morpholinomethyl)- and o-(dicyclohexylaminomethyl)-benzeneboronic acids. The latter acid shows remarkable stability to acid-catalyzed deboronation as well as dehydration. A new tetracyclic boron-containing heterocycle is reported. The structure of the compound, an o-methylene-bridged dihydrobenzoboradiazole, and some of its properties are discussed. (auth)

22822

THE EXCHANGE OF DEUTERIUM WITH METHANOL OVER RANEY NICKEL CATALYST AND THE EFFECT OF CERTAIN NITRO COMPOUNDS UPON THE EXCHANGE. Hilton A. Smith and Burch B. Stewart (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc. 82, 3898-3900(1960) Aug. 5.

Deuterium gas exchanges slowly with liquid methanol over Raney nickel catalyst at 35°. The reaction is zero order with respect to deuterium pressure and has a low activation energy. The influences of catalyst weight, catalyst treatment, and of the presence of certain nitro compounds were studied. Since active Raney nickel can liberate hydrogen directly, a method for determining the origin of hydrogen which undergoes exchange with the deuterium gas was developed. It was shown that the exchanged hydrogen does originate from the hydroxyl hydrogen of methanol. The results are discussed in the light of the mechanism of catalytic exchange and catalytic hydrogenation reactions. (auth)

22823

THE EFFECT OF CHANGING REAGENT UPON STEREOSELECTIVITY. Jack H. Stocker, Padet Sidisunthorn, Ben M. Benjamin, and Clair J. Collins (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 82, 3913-18(1960) Aug. 5.

The stereoselectivities exhibited during several reactions in which a second, adjacent asymmetric carbon atom is formed were observed. The effect of changing the organometallic reagent from phenyllithium to phenylmagnesium iodide to phenylmagnesium bromide to phenylmagnesium chloride was also studied in the addition of these reagents to biacetyl or to phenylacetoin. It was shown that the product dl : meso ratio is greater than one when either phenyllithium or phenylmagnesium iodide is employed, and less than one when phenylmagnesium bromide or chloride is employed. A similar series of reactions between benzil or methylbenzoin and the corresponding methyl reagents is also reported. All results are discussed in terms of the hypothetical intermediates. (auth)

22824

RUTHENIUM(III) CHLORIDE COMPLEXES: $RuCl_2^+$. Robert E. Connick and Dwight A. Fine (Univ. of California, Berkeley). J. Am. Chem. Soc. 82, 4187-91(1960) Aug. 20.

Ruthenium in the + 3 oxidation state in aqueous solution is known to form a number of complexes with chloride ion which equilibrate only slowly. Because of the complexity of this system, only one of these, $RuCl^{+2}$, has been isolated in solution and identified unambiguously. Two more of the complexes were obtained in pure form and characterized. The formulas of these complexes, which are cationic species, were determined by use of properties of ion-exchange resins. The total charge per species was determined by equilibrating the unknown species and hydrogen ion with ion-exchange resin in a pair of experiments. The charge per metal atom on one species was determined by a modification of a previously reported method involving the pushing of the species from an ion-exchange column with an ion of known charge. The salt of a weak acid had to be used to produce a concentrated band. The charge per metal atom of the other species was established by determination of the amount of a known ion displaced from an ion exchange column by a solution of the species. The number of chloride ions bound to the metal atom was determined by direct analysis. The species were both found to have the formula $RuCl_2^+$ and are presumed to be cis and trans isomers. The species were separable by elution from an ion-exchange column. (auth)

22825

PROPERTIES AND INFRARED SPECTRA OF ETHYLENEDIAMINETETRAACETIC ACID COMPLEXES. III. CHELATES OF HIGHER VALENT IONS. Donald T. Sawyer and Jean M. McKinnie (Univ. of California, Riverside). J. Am. Chem. Soc. 82, 4191-6(1960) Aug. 20.

Infrared spectra were recorded for the EDTA chelates of Al(III), Ce(III), Bi(III), V(III), V(IV), Cr(III), Fe(III), Co(III), Ti(IV), Th(IV), Mo(V), and Mo(VI). The spectra, when related to previous studies, indicate that the bonding between ligand and metal ion is primarily ionic for the Al(III), Ce(III), and Bi(III) chelates, and primarily covalent for the remainder of the chelates. Correlations are made between the various functional groups and their resulting absorption peaks. The EDTA chelates for this group of metal ions were synthesized and isolated. (auth)

22826

THE MECHANISM OF BASE HYDROLYSIS AND BASE CATALYZED REACTIONS OF SOME COBALT(III) AMMINE COMPLEXES. Ralph G. Pearson, Hans H. Schmidtke, and F. Basolo (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 82, 4434-5(1960) Aug. 20.

Two mechanisms, direct displacement and conjugate base dissociation, were previously proposed for the reaction of hydroxide ions with complexes of cobalt(III) containing a replaceable liquid. Some results were obtained which were easily explained by the second or conjugate base dissociation mechanism which could not be explained by the first. (M.C.G.)

22827

SOLID COMPLEXES OF ALKYLLITHIUM COMPOUNDS WITH LITHIUM HALIDES. William Glaze and Robert West (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 82, 4437(1960) Aug. 20.

A series of relatively unreactive solid complexes of alkyllithium compounds with lithium halides was prepared. Materials obtained appeared to have the formulas RLi—nLiX, where n was from 1.4 to 6. These compositions, however, appeared to be mixtures of a 1 : 1 complex RLi · LiX with excess lithium halide. The complexes were safely exposed to air. They were much more stable thermally than alkyllithium compounds. Ether apparently destroyed the complex. (M.C.G.)

22828

FURTHER STUDIES OF LEVELING USING RADIOTRACER TECHNIQUES. Seward E. Beacom and Bernard J. Riley (General Motors Corp., Warren, Mich.). J. Electrochem. Soc. 107, 785-7(1960) Sept.

The concept of the preferential adsorption of addition agent on the peaks of irregular surfaces was verified experimentally. This gave additional support to previous results which indicated that the leveling process in bright nickel-plating solutions was initiated by this preferential adsorption on peaks. A series of machined cathodes of decreasing surface roughness were prepared and plated in nickel solutions containing the addition agent, sodium allyl sulfonate, tagged with S^{35}. Results showed that the concept of preferential adsorption could be extended to include those surfaces that more nearly approached a microprofile dimension. (M.C.G.)

22829

PROTON MAGNETIC RESONANCE FOR TRICHLORACETIC ACID. Maurice Goldman (Centre d'Études Nucléaires, Saclay, France). Phys. and Chem. Solids 7, 165-9(1958). (In French)

Proton magnetic resonance spectra were observed for both monocrystalline and polycrystalline samples of trichloroacetic acid. They provided evidence that the acid is a dimer with a proton-proton distance of 2.56 ± 0.02 A. The spectrum of the single crystal was studied as a function of orientation in the magnetic field and it indicated the presence of two orientations of the proton-proton vector in the crystal, inclined at an angle of 31° ± 30′. A γ-irradiated polycrystalline sample was investigated at room temperature. The temperature of liquid nitrogen and a comparison of the spin-lattice relaxation times suggests that the $-C-Cl_3$ groups are rotating at room temperature. (auth)

22830

AQUO-OXALATO-SULFATE COMPOUNDS OF URANIUM. I. I. Chernyaev, V. A. Golovnya, and R. N. Shchelokov (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 5, 1454-66 (1960) July. (In Russian)

The following mixed aquo-acido complex uranyl compounds containing an oxalate and a sulfate group were synthesized for the first time: $K_2[UO_2(C_2O_4)(SO_4)(H_2O)_2] \cdot H_2O$, $Rb_2[UO_2(C_2O_4)(SO_4)(H_2O)_2]$, $Cs_2[UO_2(C_2O_4)(SO_4)(H_2O)_2]$, and $Cs(NH_4)[UO_2(C_2O_4)(SO_4)(H_2O)_2]$. The molecular conductivity and pH were determined in dilute solutions, and it was concluded that the decrease in stability of these complexes in aqueous solution is as follows: $[UO_2(C_2O_4)_2(H_2O)_2]^{2-} > [UO_2(C_2O_4)(SO_4)(H_2O)_2]^{2-} > [UO_2(SO_4)_2(H_2O)_2]^{2-}$. (TTT)

22831

THIOCYANATE URANYL COMPOUNDS. V. P. Markov and E. N. Traggeim. Zhur. Neorg. Khim. 5, 1467-73 (1960) July. (In Russian)

The study of uranyl thiocyanates has been hindered due to the difficulty of inducing crystallization from the concentrated, highly viscous solutions. The addition of benzene to the aqueous solution and agitation of the mixture results in almost immediate crystallization. The composition of $UO_2(CNS)_2 \cdot 3H_2O$ obtained in this way was established by thermogravimetric and conductivity studies. Dipyridyl, acridine, and triethylamine can be used to precipitate various pentathiocyanate uranyl derivates from HCl solution such as $(C_{10}H_8N_2H)_3\ UO_2(CNS)_5$, $(C_{13}H_9NH)_3\ UO_2(CNS)_5H_2O$, and $[(C_2H_5)_3NH]_3UO_2(CNS)_5H_2O$. (TTT)

22832

THE COMPLEX NATURE OF URANATES. I. I. Chernyaev, V. A. Golovnya, and G. V. Ellert (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 5, 1481-92(1960) July. (In Russian)

The uranyl ion has a coordination number of six in the majority of its synthesized compounds. It forms complexes containing up to four different addends which can be arranged in order of their ability to replace each other as follows: $CO_3^{2-} > F^- > OH^- > C_2O_4^{2-} > CH_3CO_2^- > SO_4^{2-}$, etc. The formation of dinucleate compounds is very characteristic for uranium, but the formation of polymers containing more than two atoms of U(VI) has not been observed even with carbonates which readily act as bridging groups. In solution the uranates should be considered as complex aquo-hydroxyl compounds. Complex oxy compounds can be obtained by heating the complex aquo-hydroxy compounds to a high temperature (above 300°C). Theoretically there should be 12 hydroxy uranyl complexes in which the ratio of U/OH varies from 1 : 0.5 to 1 : 6.0. Evidence for the existence of six of these hydroxyl uranyl complexes consisting of various aquo-carbonate-hydroxyl and aquo-hydroxylamine-hydroxyl complexes is presented, and plausible reasons explaining the difficulties associated with isolating the other six members of this genetic series are advanced. It is pointed out that F^- and OH^- have ionic radii that are almost the same and that they are almost equivalent in their ability to replace other addends in uranyl complexes. The uranyl fluoride complexes have been thoroughly investigated, and 10 out of the 12 theoretically possible fluoride complexes have been prepared. The similarity in composition between the fluoride and hydroxide uranyl complexes is compelling evidence that these complexes are indeed identical in composition and structure. (TTT)

22833

THIOCYANATE URANYL COMPOUNDS. V. P. Markov and E. N. Traggeim. Zhur. Neorg. Khim. 5, 1493-1501 (1960) July. (In Russian)

The following thiocyanate uranyl compounds were synthesized for the first time: $NH_4[UO_2(CNS)_3 \cdot 2H_2O]$, $K[UO_2(CNS)_3 \cdot 2H_2O]$, $Rb[UO_2(CNS)_3 \cdot 2H_2O]$, and $Cs_3[UO_2(CNS)_5]$. These compounds were synthesized by combining ammonium or potassium thiocyanate with uranyl thiocyanate or by adding $Ba(CNS)_2$ to a corresponding complex uranyl sulfate salt such as $K_2[(UO_2)_2(SO_4)_3 \cdot 5H_2O]$ in solution and then filtering off the $BaSO_4$ formed. Conductivity studies showed that uranyl thiocyanate complex dissociates into its constituent ions in aqueous solution but that the complex remains intact in methyl alcohol solutions. Ordinarily the uranyl ion possesses a coordination number of six in its complexes but the coordination number is less than six in these uranyl thiocyanate complexes. It is possible that the thiocyanate ion acts as a bridge between two uranyl ions and thus preserves a coordination number of six in these thiocyanate uranyl complexes. Thermogravimetric and chemical analyses were run on all these compounds. (TTT)

22834

DETERMINATION OF THE COMPOSITION AND DISSOCIATION CONSTANT OF Pu(IV) PHOSPHATE COMPLEXES FROM SOLUBILITY STUDIES. R. G. Denotkina, A. I. Moskvin, and V. B. Shevchenko. Zhur. Neorg. Khim. 5, 1509-15(1960) July. (In Russian)

In 2 N HNO_3 and variable H_3PO_4 content the solubility of Pu(IV) phosphate decreases to a minimum value of 1.06×10^{-4} mol/l and then increases with increasing phosphate concentration due to complexing of Pu(IV) by phosphate ions. At a concentration of H_3PO_4 of 0.012 to 0.04 mol/l the ratio of metal to addend in the complex is equal to m = 1:1. On increasing the concentration of H_3PO_4 to 0.1 mol/l, a complex with m = 2 is formed and the point of minimum solubility of $Pu(HPO_4)_2$ is attained. At higher concentrations of H_3PO_4 (>0.1 mol/l) higher complexes are formed in steps with m = 3, 4, and 5. The instability constants for the complexes $[PU(HPO_4)]^{2+}$, $[Pu(HPO_4)_2]^0$, $[Pu(HPO_4)_3]^{2-}$, $[Pu(HPO_4)_4]^{4-}$, and $[Pu(HPO_4)_5]^{6-}$ were calculated from the experimental data and were equal correspondingly to $K_1 = 1.2 \times 10^{-13}$, $K_2 = 1.8 \times 10^{-24}$, $K_3 = 3.7 \times 10^{-34}$, $K_4 = 6 \times 10^{-44}$, and $K_5 = 9 \times 10^{-53}$. Calculated solubility values of $Pu(HPO_4)_2$ in various solutions under investigation were found to agree with experimentally determined values. Electromigration experiments showed the presence of anionic complexes at higher phosphate concentrations in 2.0 N HNO_3. (TTT)

22835

SPECTROPHOTOMETRIC INVESTIGATION OF THE FORMATION OF A THORIUM COMPLEX WITH BENZO-2-ARSINIC ACID-(1-azo-2)-1, 8 DIOXYNAPHTHALENE-3, 6-DISULFONIC ACID (ARSENAZO). A. E. Klygin and V. K. Pavlova. Zhur. Neorg. Khim. 5, 1516-21(1960) July. (In Russian)

Complex formation was investigated spectrophotometrically in the system $ThCl_4-H_6R-HCl-H_2O$ where H_6R stands for arsenazo, a sensitive reagent for uranium and thorium. By analysis of plots of optical density versus pH it is possible not only to obtain the composition of a complex but also to determine the instability constant of the complex. Th^{4+} reacts with H_4R^{2-} to give a maximum yield of ThH_4R^{2+} at a pH = 1.9, as determined by calculation and confirmed experimentally. The instability constant of this complex is 7.0×10^6 and its molar extinction coefficient is E (at 590 mμ) = 2.26×10^4 and E (at 600 mμ) = 1.92×10^4. The concentration of arsenazo at a pH of 1 to 2 should be 1×10^{-4} mol/l in analyzing for thorium spectrophotometrically. (TTT)

22836

ADVANCES IN INORGANIC CHEMISTRY AND RADIOCHEMISTRY. VOLUME 2. H. J. Emeléus and A. G. Sharpe, eds. New York, Academic Press Inc., 1960. 398p. $12.00.

Eight articles are included which relate investigations into inorganic chemistry and radiochemistry. Separate abstracts were prepared for two of the articles. (B.O.G.)

Analytical Procedures

22837 AERE-AM-66

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE POLAROGRAPHIC DETERMINATION OF URANIUM IN AQUEOUS SOLUTIONS. K. R. J. Cottell. June 1960. 15p. BIS.

Uranium is separated from other metals by cellulose-alumina chromatography and is determined polarographically using either a cathode-ray or a conventional polarograph. The method as written is suitable for the determination of 5 μg of uranium upwards using the cathode-ray polarograph, or from 10 μg using the Cambridge pen-recording polarograph. (auth)

22838 AERE-R-3323

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF COPPER, CHROMIUM, LEAD AND MANGANESE IN SEA WATER. B. A. Loveridge, G. W. C. Milner, G. A. Barnett, A. Thomas, and W. M. Henry. May 1960. 42p. BIS.

Radioactive tracers were used to confirm and establish methods for the separation and concentration of copper, chromium, lead, and manganese from sea water, prior to the determination of their concentrations spectrophotometrically. Detailed procedures are given for the determination of these elements at their natural concentrations in sea water. Average values found for soluble copper range from 0.9 to 1.5 μg per liter; for chromium 0.13 to 0.25 μg per liter; for lead 0.6 to 1.5 μg per liter; and for manganese 0.6 to 1.4 μg per liter. These four elements were found in sea water in association with suspended solid matter, which was removed by passing the sea water through filters capable of retaining particles with a diameter greater than about one micron. Procedures are given for the spectrometric determination of copper, chromium, lead, and manganese on the separated solids. (auth)

22839 AERE-R-3335

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE ANALYSIS OF BERYLLIUM BY FLUORESCENT X-RAY SPECTROGRAPHY. J. T. Campbell and H. I. Shalgosky. May 1960. 9p. BIS.

The sample preparation and instrumental conditions for the determination of trace impurities in beryllium metal by fluorescent x-ray spectrography are reported. The advantages and limitations of this application of the technique are discussed. (auth)

22840 CF-60-8-25

Oak Ridge National Lab., Tenn.

COMPARISON OF WEIGHT CHANGES OF COLUMBIUM SPECIMENS WITH AMOUNT OF IMPURITIES AS DETER-

MINED BY VACUUM FUSION ANALYSES. H. E. McCoy. Aug. 3, 1960. OTS.

Columbium specimens were contaminated with various amounts of hydrogen, oxygen, and nitrogen. The per cent weight changes are compared with the concentration of contaminants as determined by vacuum-fusion analyses. Good agreement was obtained for samples contaminated with oxygen. The concentration of impurities found analytically in specimens containing large amounts of nitrogen was lower than indicated by the per cent weight change. Considerable scatter was observed at nitrogen concentrations of less than 0.10 wt.%. Similar results were observed when hydrogen was the primary contaminant. (auth)

22841 HW-64170

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE ANALYSIS OF PLUTONIUM-241 IN URINE. J. J. Donald Ludwick. Mar. 23, 1960. 9p. Contract AT(45-1)-1350. OTS.

A method was developed for the quantitative determination of plutonium-241 in exposed personnel through urine analysis. The procedure was designed for use, when necessary, in conjunction with the Hanford plutonium bio-assay technique of alpha analysis. The method is based on the recovery of plutonium from electrodeposited discs and subsequent extraction of the plutonium from 1 N hydrochloric acid into a liquid scintillator containing dibutyl phosphate. The plutonium-241 beta emission is detected in a standard liquid scintillation spectrometer. The yield for plutonium recovery using spiked samples of Pu^{241} was 85 ± 9%. Samples containing as little as 2.2×10^{-6} μc of Pu^{241} may be reliably detected. This represents 3.5% of the maximum permissible dose 90 days after personnel exposure. (auth)

22842 PGR-84(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHOD FOR THE RADIO-CHEMICAL DETERMINATION OF STRONTIUM-89 AND STRONTIUM-90 IN PLANT SOLUTIONS. Feb. 1960. 15p. BIS.

Radio-strontium, together with added strontium carrier, is separated and the β-activity measured through an absorber thick enough to absorb the low-energy radiation of the strontium-90. After counting, the source is allowed to stand for three days, and the yttrium-90, together with added yttrium carrier, is separated and the β-activity measured. The counting equipment is calibrated with sources of strontium-89 and strontium-90 of known activity. Alternatively the source may be counted again after three days without separating the yttrium. (auth)

22843 PG-Report-125

United Kingdom Atomic Energy Authority. [Production Group. Chemical Services Dept.]. Windscale, Sellafield, England.

ANALYTICAL METHOD FOR THE POLAROGRAPHIC DETERMINATION OF CADMIUM IN NITRIC ACID SOLUTIONS OF URANYL NITRATE. 1960. 7p.

The cadmium is extracted into carbon tetrachloride from the acid solution as the dithiozone complex, back extracted into hydrochloric acid, and determined using an a-c polarographic procedure. Of the elements which are co-extracted, only lead interferes. (auth)

22844 TID-6325

Michigan. Univ., Ann Arbor.

INDIRECT NEUTRON ABSORPTIOMETRY. W. Wayne Meinke. [1957]. 5p. Project No. 7. Contract AT(11-1)-70. OTS.

Investigation of neutron absorption for use in analysis of common elements such as fluorine is discussed. Preliminary results indicate that indirect neutron absorptiometry is sound and that values reproducible to within a few per cent can be rapidly obtained by this technique. The method should also be applicable to ions other than fluoride which form insoluble compounds with gadolinium. (J.R.D.)

22845 CEA-tr-X-207

ANALYSE DU ZIRCONIUM ET DE SES ALLIAGES. (Analysis of Zirconium and Its Alloys). Translated into French by S. S. Minn from Bunseki Kagaku 7, 742-9(1958). 28p.

A bibliographic résumé is presented of articles on the analysis of Zirconium for other elements in its alloys and impurities. Chemical Abstracts, other bibliographies, and books were consulted. A table is presented which lists analytical methods for Zirconium, the reagent used, product used for gravimetry, effects of other elements, and the workers. 95 references. (T.R.H.)

22846

THE PHOTOCOLORIMETRIC TITRATION OF THORIUM BY PYROCATECHOL VIOLET. C. Drăgulescu, T. Simonescu, and I. Menessy. Acad. rep. populare Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări, Ştiinţe chim. 6, No. 3/4, 21-6(1959) July-Dec. (In Rumanian)

The conditions for the formation of compounds of thorium with pyrocatechol violet (PCV) are determined in order to utilize them in colorimetry. In the case of the direct titration of thorium with PCV, three compounds, which correspond to the stoichiometric ratios of Th_4(PCV), Th_2(PCV), and Th(PCV), are formed consecutively. In the case of inverse titration only two compounds are identifiable. These are Th_2(PCV) and Th(PCV). An analysis of the diagrams shows that only one point, which corresponds to the formation of a complex whose composition is Th(PCV), can be utilized for quantitative determination. The tests can be made with 0.7 to 5 γ/ml of thorium salts with errors between −3.62% and +2.2%. (tr-auth)

22847

DETERMINATION OF MOLYBDENUM IN NITRILOTRIACETIC ACID MEDIUM BY DERIVATIVE POLAROGRAPHY. APPLICATION TO SOLUTIONS OF MIXED THORIUM—URANIUM OXIDES. D. L. Manning, R. G. Ball, and Oscar Menis (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 1247-50(1960) Sept.

A supporting electrolyte composed of 0.15M nitrilotriacetic acid (NTA) at a pH of 3.0 was utilized for the determination of Mo by derivative polarography. The method is applicable to the determination of Mo in ThO_2 samples which also contain U. Major interferences include Cr(VI), Cu(II), Sn(IV), and Ni(II); however, 80 to 100 μg of these ions can be tolerated at the 70-μg Mo level. It is postulated that the Mo waves which occur at half-wave potentials of −0.22, −0.35, and −0.48 volt vs. S.C.E. are due to the reduction of Mo(VI) species, whereas the wave at −0.65 volt vs. S.C.E. is caused by the reduction of Mo(V) at the dropping mercury electrode. (auth)

22848

DIRECT TITRATION OF POTASSIUM WITH TETRAPHENYLBORATE. AMPEROMETRIC EQUIVALENCE-POINT DETECTION. David L. Smith, Donald R. Jamieson, and Philip J. Elving (Univ. of Michigan, Ann Arbor). Anal. Chem. 32, 1253-7(1960) Sept.

Tetraphenylborate ion gives two anodic voltammetric waves at the graphite electrode in aqueous solution which can be used to follow the concentration of the tetraphenylborate ion. This electroactivity was made the basis for the direct titrimetric determination of potassium via its precipitation as potassium tetraphenylborate. The resulting method is simple and rapid; there is no need to filter, wash, and redissolve the precipitate as in the indirect titration methods proposed for the determination of potassium by precipitation with tetraphenylborate. The method is also more convenient, rapid, and flexible than other proposed direct titration methods for potassium. It is relatively free from interferences, tolerating the presence of large amounts of chloride and other commonly encountered anions. The procedure was satisfactorily applied to the direct determination of potassium in silicates and other refractory samples after sulfuric-hydrofluoric acid dissolution and fuming. (auth)

22849

NEUTRON ACTIVATION ANALYSIS FOR IRIDIUM IN PLATINUM. Lloyd S. Jowanovitz, Fred B. McNatt, Robert E. McCarley, and Don S. Martin, Jr. (Ames Lab., Ames, Iowa). Anal. Chem. 32, 1270-2(1960) Sept.

A procedure is given for a high sensitivity neutron activation analysis for Ir in Pt which permits the use of Pt^{195m} as a tracer. The standard deviation of seven analyses of a 0.04-p.p.m. sample was 10%. Analyses were not influenced by differences in the neutron spectrum and no interference from (n, p) processes was evident at the 0.04-p.p.m. level. The activation of Pt^{195m} as an internal standard was unsatisfactory and an external standard is recommended. The effectiveness of separation procedures of Ir from Pt was evaluated with the high sensitivity of the radiochemical procedure. The fractional crystallization of K_2PtBr_6 is proposed as the best means for the purification of Pt from an Ir impurity. (auth)

22850

ION EXCHANGE SEPARATION AND SPECTROGRAPHIC DETERMINATION OF SOME RARE EARTHS IN BERYLLIUM, URANIUM, ZIRCONIUM, AND TITANIUM METALS, ALLOYS, AND OXIDES. COLLECTION WITH CALCIUM AND MAGNESIUM FLUORIDE AND ION EXCHANGE SEPARATION. Silve Kallmann, Hans K. Oberthin, and James O. Hibbits (Ledoux & Co., Teaneck, N. J.). Anal. Chem. 32, 1278-81(1960) Sept.

Yttrium, precipitated as the fluoride through coprecipitation of Ca plus MgF, quantitatively collects the fluorides of Eu, Dy, Gd, and Sm, even in the presence of large amounts of U, Be, Ti, or Zr. The filtered and ignited fluoride mixture is converted to sulfates and the Ca and Mg plus residual matrix elements are removed by ion exchange. Yttrium is recovered as oxalate prior to subjecting it and the coprecipitated rare earth to spectrographic analysis. (auth)

22851

DETERMINATION OF LANTHANUM, CERIUM, PRASEODYMIUM, AND NEODYMIUM AS MAJOR COMPONENTS BY X-RAY EMISSION SPECTROSCOPY. David R. Maneval and Harold L. Lovell (Pennsylvania State Univ., University Park). Anal. Chem. 32, 1289-92(1960) Sept.

The advantages of the fused disk technique in x-ray emission spectroscopy suggest its application to analyses of the rare earths. Improvements in accuracy, convenience, speed, and economy result from this process. Standard disks for Ce, La, Pr, and Nd are prepared by fusion with sodium borate and are employed for daily calibration. The analyses of four samples of widely varying composition show a mean error of less than 5%. With these four elements, interference from other rare earth oxides is generally insignificant. (auth)

22852

SPECTROPHOTOMETRIC DETERMINATION OF FLUORIDE IN WATER. Floyd I. Brownley, Jr. and Charles W. Howle, Jr. (Clemson Coll., S. C.). Anal. Chem. 32, 1330-2 (1960) Sept.

A spectrophotometric method for the determination of fluorides in water uses a thorium-phenylfluorone lake. This lake is bleached by the fluoride ion, and distillation is not necessary. Interfering cations are removed by an ion exchange column. (auth)

22853

SEPARATION AND SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF MERCURY USING DIETHYLDITHIOCARBAMATE. E. A. Hakkila and G. R. Waterbury (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 32, 1340-2(1960) Sept.

Microgram amounts of Hg are separated from most metallic ions by extraction of the Hg-diethyldithiocarbamate complex into CCl_4 from a carbonate buffered solution containing (ethylenedinitrilo)-tetraacetate and cyanide to mask interfering ions. The Hg is determined by measuring the absorbance of the extract at 278 mμ. Of 32 ions investigated only Cu, Tl(III), and Bi(III) interfere seriously. If more than 200 μg of Ru are present, it must be removed by hypochlorite oxidation. Based upon data for 14 determinations at each concentration, coefficients of variation of 5 and 2% for 10 and 50 μg of Hg, respectively, were obtained. One analyst can perform up to 30 determinations per day. (auth)

22854

SPECTROPHOTOMETRIC DETERMINATION OF BERYLLIUM WITH 2-PHENOXYQUINIZARIN-3,4′-DISULFONIC ACID. E. Guy Owens, II and John H. Yoe (Univ. of Virginia, Charlottesville). Anal. Chem. 32, 1345-9(1960) Sept.

Be reacts with 2-phenoxyquinizarin-3,4′-disulfonic acid (dipotassium salt) to form a stable violet complex (λ_{max}= 550 mμ). The reaction was applied to the spectrophotometric determination of Be in beryl, Cu alloys, Al, and spiked samples of bronze and steel. The practical sensitivity of the reaction is 1 part of Be in 125,000,000 parts of solution. Large quantities of interferences are separated by ion exchange or by electrolysis at the Hg cathode. Many interferences, including Al, present in moderate amounts are masked by adding the calcium salt of (ethylenedinitrilo)tetraacetic acid as a sequestering agent. Out of 64 ions investigated only Cr^{+3}, Mg^{+2}, Zr^{+4}, Th^{+4}, F^{-1}, and PO_4^{-3} interfere seriously when CaEDTA is used as a sequestering agent. Development of the method included a study of the effects of temperature and pH, the stability of the complex, and its rate of formation. (auth)

22855

SPECTROPHOTOMETRIC TITRATION OF DIVALENT METALS WITH 1-NITROSO-2-NAPHTHOL IN N,N-DIMETHYLFORMAMIDE. Irene T. Takahashi and Rex J. Robinson (Univ. of Washington, Seattle). Anal. Chem. 32, 1350-2(1960) Sept.

1-Nitroso-2-naphthol, an organic precipitating agent, can be used as a volumetric reagent for the titration of micro amounts of divalent metals in a N,N-dimethylformamide solution. Spectrophotometric titrations of 0.01 μmole of copper(II) and 10.0 μmoles of Ni(II) in 40 ml of solvent can be performed with a precision of 2 parts per 1000. Pb(II), Zn(II), and uranyl ions also chelate with nitrosonaphthol in dimethylformamide. The usefulness of nitrosonaphthol as a titrant in dimethylformamide is limited somewhat by its gradual decomposition in this solvent. (auth)

22856

RADIOCHEMICAL EVALUATION OF SOLVENT EXTRACTION OF INDIUM AS THE BROMIDE AT HIGH CONCEN-

TRATIONS. Edward B. Owens (Massachusetts Inst. of Tech., Lexington). Anal. Chem. 32, 1366-7(1960) Sept.

Extractions of In in concentrations of 0.1 to 0.7 M from 4.5 N HBr were made with 2-pentanone and diethyl ether. A single extraction with 2-pentanone gave the highest extraction efficiency at 0.3 M In over the range of 0.3 to 0.6 M. At all concentrations 2-pentanone was a better extraction solvent than diethyl ether. (M.C.G.)

22857

COLORIMETRIC DETERMINATION OF PALLADIUM IN URANIUM–FISSION ELEMENT ALLOYS. L. E. Ross, G. Kesser, and E. T. Kucera (Argonne National Lab., Ill.). Anal. Chem. 32, 1367-8(1960) Sept.

Palladium, in the presence of U, was quantitatively extracted in the form of the naphthalate complex with toluene in a pH range of 1.0 to 2.0. The excess reagent was also extracted. No U precipitation occurred. EDTA was used to buffer the solution as well as to mask interfering elements. The excess 2-nitroso-1-naphthol was scrubbed from the toluene phase with dilute NaOH. (M.C.G.)

22858

DETERMINATION OF FLUORINE BY NEUTRON ACTIVATION. Oswald U. Anders (Dow Chemical Co., Midland, Mich.). Anal. Chem. 32, 1368-9(1960) Sept.

A method for the determination of F by neutron activation was developed. A fast-transfer shuttle rabbit system permitting multiactivation runs with cumulative counting was designed to improve both sensitivity and statistical certainty of the analysis. The basis of the analysis was the production of the 7.4 sec N^{16}. Use of the penetrating 6.1 Mev gamma radiation from N^{16} permitted the determination of F in the presence of most other elements. (M.C.G.)

22859

POLAROGRAPHIC DETERMINATION OF TRACES OF EUROPIUM IN MINERALS AND ORES. V. T. Athavale, R. G. Dhaneswar, and M. M. Mehta (Atomic Energy Establishment, Trombay, India). Anal. Chim. Acta 23, 71-3 (1960) July. (In English)

A method is described for the determination of as little as 10 to 12 ppm of europium in minerals and ores. After lead separation the total rare earths are separated by conventional methods and the rare earth oxides are dissolved in hydrochloric acid. Europium gives a wave in 0.1 M ammonium chloride supporting electrolyte at −0.67 v vs. S.C.E. and there are no interferences. Europium is determined in monazite and samarskite. (auth)

22860

POLAROGRAPHIC DETERMINATION OF NICKEL, CHROMIUM AND TIN IN ZIRCALOY AND ZIRCONIUM METAL. V. T. Athavale, R. G. Dhaneswar, and M. M. Mehta (Atomic Energy Establishment, Trombay, India). Anal. Chim. Acta 23, 74-7(1960) July. (In English)

Polarographic methods are described for the determination of chromium, nickel, and tin in Zircaloy. The methods can be used to determine these three elements at the 10 ppm level in pure zirconium metal. (auth)

22861

THE DETERMINATION OF MICROGRAM AMOUNTS OF FLUORINE BY DIFFUSION. R. J. Hall (Agricultural Research Council, Cambridge, Eng.). Analyst 85, 560-3 (1960) Aug.

The determination of small amounts of fluorine in biological samples without distillation was described. The method involves the collection of fluorine by diffusion in a polythene bottle, absorption by alkali-treated filterpaper and subsequent titration with thorium nitrate solution in the presence of alizarin sulphonate. The method is simple and it is not complicated by the problems associated with conventional distillation techniques. (auth)

22862

SPECIFIC DETERMINATION OF URANIUM (AND COPPER) WITH GLYOXAL-BIS-(2-HYDROXYANILINE). F. Umland and K. U. Meckenstock (Institut für Anorganische Chemie, Hanover). Agnew. Chem. 72, 324(1960) May 7. (In German)

An improved separation procedure for uranium was described for use with the spectrophotometric method using glyoxal-bis-(2-hydroxyaniline). The uranium was complexed at pH 12.5 to 13 in a tartrate-containing 1 : 1 H_2O–CH_3OH mixture at room temperature. The copper, which forms a more stable complex than the uranyl ion, was completed by adding EDTA (Na). Excess reagent was taken up by adding a lead salt. This solution was then treated with the glyoxal-bis-(2-hydroxyaniline) for spectrophotometry at 560 to 590 mμ against a uranium-free blank. (T.R.H.)

22863

DETERMINATION OF TRACE ELEMENTS IN LIGNITE ASHES. Robert L. O'Neil and Norman H. Suhr (Pennsylvania State Univ., University Park). Appl. Spectroscopy 14, 45-50(1960).

Two spectrographic methods for the quantitative determination of trace elements in lignite ashes and shales are described. The involatile elements are determined in a controlled atmosphere of carbon dioxide gas that suppresses cyanogen bands, improves line to background ratio, and provides a more precise technique for the simultaneous determination of a large number of elements. Lutecium oxide in calcium carbonate and fused potassium sulfate (1 + 1) is used as the internal standard. The volatile elements are determined in an ordinary d-c arc, with the use of a pellet technique to increase the limit of detection and rate of volatilization. Antimony and cadmium oxides in fused potassium sulfate are used as internal standards. Analyses of U. S. Geological Survey standard rock samples G-1 and W-1 show that the method can be extended to other silicate rocks. An additional application of the controlled carbon dioxide atmosphere is the determination of boron and gallium. (auth)

22864

A PROCEDURE FOR DETERMINING THE DEGREE OF ENRICHMENT OF U^{235} FROM THE ALPHA ACTIVITY OF THE URANIUM ISOTOPES. F. Bernhard, G. Blumentritt, and J. Schintlmeister (Lehrstuhl für Kernspektroskopie der Technische Hochschule, Dresden). Atompraxis 6, 154-8 (1960) Apr.-May. (In German)

If U^{235} is enriched by diffusion, the ratio between the isotopes U^{234} and U^{238} is altered. Measurement of the intensity of the α rays of these isotopes indicates the degree to which U^{235} has been enriched. The procedure is especially sensitive to slight enrichment. The measurements can be carried out easily. A proportional counter counts the α rays emitted from a very thin layer of uranium surrounding the counter at a distance of 14 cm. Because of this considerable distance, the surface of the preparation is 1900 cm^2. The rays are collimated. The range distribution of the α rays from the preparation is registered by changing the air pressure in the measurement chamber. The voltage of the counter is adjusted according to the pressure. (auth)

22865

POLAROGRAPHIC STUDY OF PROPERTIES AND DETERMINATION OF TRIVALENT AND TETRAVALENT CERIUM. J. Dolezal. Chem. Anal. (Warsaw) 3, 407-19(1958).

(Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86101).

It was found that use of K_2CO_3 as complex-forming reagent permits shift to be made in the potential of the Ce^{3+}/Ce^{4+} system toward more negative values (in 0.75 M K_2CO_3 down to −0.095 mv and in 2 M K_2CO_3 down to −0.160 mv) and to obtain a well-defined polarographic wave suitable for quantitative determinations. The oxidized form of the complex contains 3 more CO_3^{2-} groups than the reduced form (both complexes contain a single, central atom of Ce). Of the possible electrode reactions, only the reaction $[Ce(CO_3)_2]^- + 3CO_3^{2-} = [Ce(CO_3)_5]^{6-} + e$ corresponds to experimental data. To eliminate interfering effect of other elements (Fe, Al, Cr, Zn, Ni, V, Ti, Mo, W, Sn, Bi, Sc, Y, U, Th), the polarographic determination of Ce is carried out in 1 M solution of K-Na-tartrate. Optimal background for Ce determination is 2 M K_2CO_3. The polarographic method permits a determination of up to 5% Ce in lanthanum and scandium, up to 0.1% Ce in thorium and uranium, and 0.5% Ce in yttrium. On using this method for determination of Ce in metallic Ce, in alloys containing Th, Al, and Mg, in monazite sand, and in other materials, results were obtained which are in agreement with the data of other methods.

22866

POTENTIOMETRIC DETERMINATION OF URANIUM IN THE PRESENCE OF VANADIUM, CHROMIUM, AND IRON, BY MEANS OF DIVALENT-CHROMIUM SALT.

J. Minczewski and S. Kolyga. Chem. Anal. (Warsaw) 3, 467-73(1958). (Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86139).

A method was developed for potentiometric titration of U(VI), V(V), Fe(III), and Cr(IV) mixtures with solutions of $CrSO_4$. Titration is carried out in a cell with Pt-electrode and saturated calomel electrode with continuous passing of a mixture of CO_2 and H_2. The concentration of H_2SO_4 in titrated solutions is about 5%. Under these conditions the titration curve shows inflection points corresponding to reduction of Cr(VI) to Cr(III), V(V) to V(IV), Fe(III) to Fe(II), and one inflection which corresponds to reduction of U(VI) to U(IV) and V(IV) to V(III). The content of Cr(VI), V(V), and Fe(III) is determined from the first 3 jumps of potential; the content of U(VI) is calculated from the last inflection of the curve by subtracting the amount of $CrSO_4$ solution that is needed for the reduction of V(IV) to V(III) (which is determined from the 2nd jump of potential). On titration of Cr(VI), V(V), Fe(III), and U(VI), the average error amounts to 0.1, 0.2, 0.2, and 0.3 ml 0.1 N solution of $CrSO_4$, respectively.

22867

COMPLEXOMETRIC DETERMINATION OF THORIUM, LANTHANUM, AND TRIVALENT CERIUM WITH THE USE OF CARMINIC ACID.

J. Dobrowolski. Chem. Anal. (Warsaw) 3, 609-14(1958). (Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86055).

It was found that solutions of carminic acid, which are yellow at pH less than 7, acquire a violet coloration in the presence of La^{3+} and Ce^{3+}; on addition of Th the solutions acquire a blue color. For a complexometric determination of Th, using carminic acid as an indicator, 0.05 to 1.00 ml of the solution being analyzed are added to a 3 ml buffer solution of pH 2 (mixture of 0.1 N HCl and 0.1 N glycol). The mixture is heated to boiling, several drops of 1% ethanol solution of carminic acid are added, and titration is carried out with 0.01 to 0.1 M solution of Complexon III until the blue color of the solution changes to yellow. In the titration of 0.3 mg Th the determination error is less than 11%; in the case of larger amounts (more than 6 mg Th) it drops to less than 2%. For determination of La or Ce (or of their sum) 0.05 to 1.00 ml of the solution being analyzed are added to a 3 ml buffer solution of pH 3.7, and titration with a solution of Complexon III is carried out until the violet color of the solution changes to yellow. Accuracy of the determination is the same as in the case of Th. If Th is being determined in solutions containing La and Ce in approximately the same amounts, titration is carried out without their separation (Th content in the sample must be at least 5 mg). The determination error is less than 3.5%. In the determination of La and Ce in the presence of Th, the Th is first precipitated with H_2O_2. In such a case the results of the determination of La and Ce are somewhat too low (up to 10%) which is attributed to possible losses during the separation of Th.

22868

DETERMINATION OF LITHIUM IN AMMONIUM FLUORIDE AND HYDROFLUORIC ACID.

W. Kemula and A. Hulanicki. Chem. Anal. (Warsaw) 3, 721-8(1958). (Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86066).

A flame spectrographic method was developed for determining 4×10^{-4} to 15×10^{-4} % Li in NH_4F or HF. The spectra are excited in an air-acetylene flame and photographed in a 2-prism glass spectrograph. Rubidium is used as an internal standard; a solution of 0.5% K is added to the solution being analyzed to eliminate the effect of varying amounts of K on the intensity of the Rb lines. The sample of HF or NH_4F (10 g) is evaporated to dryness in a Pt-dish 1 ml 72% $HClO_4$ is added, the mixture is heated to evolution of $HClO_4$ vapor and cooled; five milliliters 9.52% solution KCl, 1 ml 0.025% solution Rb salt, and 5 ml 2.5 N HCl are added, and the mixture is diluted to 50 ml with water. Then photography of the spectra is carried out (60 seconds) during the process of introducing the solution into the flame. Lithium 670.8 mμ and Rb 794.8 mμ lines are photometered. The calibration graph is plotted on the basis of difference in blackening of Li and Rb lines for which purpose, on each plate, photographs are taken of spectra of solutions containing Li in a concentration of 0.7, 1.2, 1.8, 2.5, and 3.5 γ/ml, and other components of the sample. Error of a single determination is 5.7%. Admixtures of other elements in the samples, when present in amounts up to 0.05% (Na, Ca, K) and 0.01% (Fe, Cu, Pb, Al, PO_4^{3-}, SO_4^{2-}), do not affect the accuracy of the analysis.

22869

DETERMINATION OF THORIUM IN MONAZITES BY THE METHOD OF AMPEROMETRIC TITRATION.

Shao-chun Tung and Er-kang Wang. Hua Hsüeh Hsüeh Pao 25, 33-7 (1959). (Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86117).

Decomposition of material being analyzed is effected by fusion with KHF_2. Amperometric titration of thorium is carried out with a background of 1.5 N $AlCl_3$−7% CH_3COOH−0.4% CH_3COONa (pH 1.7) at 0.75 v (relative to saturated calomel electrode) by using ammonium molybdate as titrant. Duration of determination is 3 hours; the error is ±2%.

22870

THE FLUOROPHOTOMETRIC DETERMINATION OF URANIUM IN HUMAN URINE.

Jun Akaishi (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 379-88(1960) July. (In Japanese)

A new fluorophotometer was constructed and several experiments were carried out for the rapid determination of uranium in human urine. The experiments were carried out on the effect of the fusion time, the optimum composition and amount of the fusing agent, the quenching of fluorescence by coexisting calcium and magnesium, the relation between fluorescence and the sample amount, the distribution of the intensity of fluorescence in the fused cake, cleaning of the platinum dish, and the detection limit of uranium. The evaporated residue of 1 ml of sample urine was fused with 0.8 g of the fusion mixture (NaF + $NaKCO_3$) in a platinum dish for 2 min at 850 to 900°C. The detection limit of uranium was 0.001 to 0.002 μg/ml for human urine. The accuracy of the method was about 4% in the presence of 0.011 μg of uranium per dish. (auth)

22871

TITRIMETRIC DETERMINATION OF ZIRCONIUM. I. TITRATION OF ZIRCONIUM WITH POTASSIUM PERMANGANATE IN AN ALKALINE MEDIUM. Anna Schneer and Hilda Hartmann. Magyar Kém. Folyóirat 65, No. 1, 35-6 (1959). (Translated from Referat. Zhur. Khim. No. 20, 1959, abstract No. 71239).

The possibility of an indirect determination of Zr by an oxidation-reduction titration of mandelic acid with $KMnO_4$ solution was studied. As a preliminary step the method of titrating mandelic acid and p-bromomandelic acid with $KMnO_4$ solution in an alkaline medium (1 to 2N NaOH) was worked out; Nb_2O_5, Ta_2O_5, SiO_2, and WO_3 did not interfere. The compounds were quantitatively oxidized in the titration to benzoic and p-bromobenzoic acid. Approximately 11% more than the theoretical amount of $KMnO_4$ was used up, apparently because of auto-decomposition. The precipitation of Zr with mandelic acid took place quantitatively, and the precipitate formed had a stoichiometric composition. In the determination of Zr, the solution to be analyzed, which contained 2 to 20 mg Zr was evaporated to 20 to 100 ml; fifteen to eighty milliliters concentrated HCl was added, the solution was heated to 95°, fifteen to eighty milliliters concentrated 16% solution of mandelic acid was added dropwise while stirring, and the mixture was kept on a water bath for several hours. After 1 to 2 days the precipitate was filtered off using a glass filter, washed first with mother liquor, then with ethanol and ether, dried at 110 to 120°, and dissolved in 5 to 6N Na_2CO_3 (4 portions of 5 ml each) on the filter while applying suction. To the resulting solution 10 ml of 23% NaOH solution and 20 ml 0.5N $KMnO_4$ were added. The solution was allowed to stand for 10 min, acidified with an H_2SO_4 solution, and, on adding 20 ml 0.5N $H_2C_2O_4$, heated to 60° and titrated with 0.1N $KMnO_4$ solution. A control experiment was conducted simultaneously. 1 ml 0.1N $KMnO_4$ corresponded to 0.5136 mg Zr. The error was ±1%.

22872

PHOTOMETRIC DETERMINATION OF THORIUM BY MEANS OF THORON. G. Almassy and B. Hadobas. Magyar Tudományos Akad., Kem. Tudományok Osztályának, Közleményei 11, No. 1, 5-10(1959). (Translated from Referat. Zhur. Khim. No. 1, 1960, abstract No. 857).

A technique was developed for the determination of thorium in ores. The ore specimen is melted with $KHSO_4$ (5 g per 1 g of ore), the melt is dissolved in concentrated HCl during a 30 to 40 min period, the solution is filtered (to eliminate SiO_2 and TiO_2) and Fe^{3+}, Al^{3+}, and Th^{4+} in the filtrate are precipitated with ammonia. The precipitate is dissolved in HCl, tartaric acid is introduced, a 10% solution of ascorbic acid (to reduce Fe^{3+}) is added, 5 ml of 0.04% aqueous solution of thoron are added, and the solution is photometrically analyzed. The sensitivity of Th determination is increased (up to 0.001%) if ethanol, methanol, or acetone (up to 40 to 70%) is added to the analyzed solution.

22873

DETERMINATION OF OXIDES IN STEELS. P. Torterat, L. Bäcker, and E. Herzog (Aciéries de Pompey, France). Mém. sci. rev. mét. 57, 493-501(1960) July. (In French)

The work is described which was carried out on the identification and determination of the oxides in steels by a vacuum fractional reduction method at stepped temperatures and by the method of residues. The results agree with each other and the two methods are complementary. (auth)

22874

ISOTOPIC ANALYSIS OF SILICON BY SOLID SOURCE MASS SPECTROMETRY USING NEGATIVE IONS. D. C. Newton, J. Sanders, and A. C. Tyrrell (Plessey Co., Ltd., Caswell, Northants, Eng.). Nature 187, 683(1960) Aug. 20.

A mass spectrometer with electron multiplier and a triple tungsten filament loaded with Cs_2SiO_3 as source was used for the isotopic analysis of silicon. No positive ions were detected, but when the accelerating voltage and magnetic field polarities were reversed, negative ions were found corresponding to SiO_3^- at m/e values of 76, 77, and 78. (D.L.C.)

22875

DETERMINATION OF THE QUANTITY OF THE RADIOACTIVE STRONTIUM IN THE ORGANISM BASED ON ITS ELIMINATION IN THE URINE. T. Trnovec, K. Ďurček, E. Faithová, and V. Zbořil (Inst. of Industrial Hygiene, Bratislava). Pracovní lekărstvî 12, 297-9(1960) June. (In Czech.)

A description is given of a method for the determination of the quantity of radioactive strontium in the organism, sufficient for the occupational-hygienical praxis. Out of the radioactive strontium eliminated with 24 hours the exposure dose is calculated as well as the quantity retained at present in the organism. (auth)

22876

DETERMINATION OF HYDROGEN IN METALS: A CARRIER GAS METHOD. F. R. Coe (British Welding Research Assn., Abington, Cambridgeshire, Eng.). Research (London) 13, 323-7(1960) Aug.

A new method was described for the rapid determination of hydrogen in metals. By using an inert-carrier gas technique together with a thermal-conductivity detector, complicated glass vacuum systems are avoided and small amounts of hydrogen in the carrier gas may be measured directly. The simplicity of the system makes it eminently suitable for routine control purposes and its flexibility is a useful feature in research. (auth)

22877

SEPARATION AND DETERMINATION OF MICROQUANTITIES OF EUROPIUM IN URANIUM. Heriberto A. Braier. Rev. fac. cienc. quím., Univ. nacl. La Plata 31, 151-7 (1959). (In Spanish)

The separation of microquantities of rare earths from uranium was studied using cation exchange resins and Eu^{154} as a tracer. The cation resin was used since the uranium is not fixed on it at all. Uranyl sulfate was used as the uranium compound. The eluant used was 6 M hydrochloric acid. The elution curves obtained are shown. The europium was determined spectrographically after its separation. (J.S.R.)

22878

ENRICHMENT CONTROL OF FUEL ELEMENTS. P. Thome and B. Bailly du Bois (Commissariat à l'Énergie Atomique, Saclay, France). Rev. met. 56, 451-6(1959). (In French)

Uranium-235 content in a fuel element is controlled by filtrating and counting the fission neutrons. When machined and canned elements are measured, the absolute error is about 0.005 for an enrichment of 1.35. Indirectly, it is possible by this method to recognize alloying components of uranium in the fuel. (auth)

22879
SPECTROCHEMICAL DETERMINATION OF La AND Sc IN STANDARD GRANITE G1 BY THE METHOD OF ADDITION. S. Held (Israel Atomic Energy Commission, Tel Aviv). Spectrochim. Acta 16, 588-94(1960) June.

The determination of lanthanum and scandium in standard granite G1 was carried out by the method of addition. The confidence limits of the unknown concentration obtained with two sets of two additions were compared with the limits obtained with a single addition and were found to be of the same order of magnitude. In geological work a single addition may often be sufficient for relatively rapid semiquantitative determinations. (auth)

22880
11th ANNUAL PITTSBURGH CONFERENCE ON ANALYTICAL CHEMISTRY AND APPLIED SPECTROSCOPY, [FEBRUARY 29 TO MARCH 6, 1960]. Spectrochim. Acta 16, 605-31(1960) June.

Abstracts are given of papers presented at the spectroscopic sessions of the 11th Annual Pittsburgh Conference on Analytical and Applied Spectroscopy held from February 29 to March 6, 1960. One hundred and two papers covering the fields of emission spectroscopy, atomic absorption spectroscopy, infrared spectroscopy, molecular fluorescence, spectrophotometry and rotatory dispersion, x-ray spectroscopy, and nuclear magnetic resonance were presented. (M.C.G.)

22881
SPECTRAL DETERMINATION OF ADMIXTURES IN METALLIC ZIRCONIUM. Li-hsuan Ch'en (Ssu-ch'ih Ch'ao). Wu Li Hsüeh Pao 15, 311-15(1959). (Translated from Referat. Zhur. Khim. No. 1, 1960, abstract No. 880).

The analyzed metal is treated with NaF and HNO_3, the solution is evaporated, and the residue is roasted at 700°C, mixed with carbon powder and NaH_2PO_4 (buffer), and placed in the opening of the carbon electrode. The spectra are excited in an arc discharge of alternating current at 10 amp and photographed on the medium spectrograph ISP-22. The elements Mg, Mn, Fe, Ti, Si, Mo, Cu, Cr, Co, and Hf are determined spectrographically in zirconium within the limits of concentrations from 0.1 to 0.001 ~0.03%, depending on the element. The influence of various additions (buffers) upon the kinetics of the evaporation of admixtures was studied. As analyticals, the most sensitive lines of the admixtures and the lines Zr 2875, 2844, and 2814 A were used.

22882
THE COMPONENT ANALYSIS OF BINARY SYSTEMS FROM THE ABSORPTION OF γ-RADIATION. V. S. Merkulov and A. V. Klimushev. Zhur. Fiz. Khim. 34, 1373-6(1960) June. (In Russian)

The absorption of γ radiation was used for the component analysis of binary systems. As such systems various mixtures, emulsions, solutions, and chemical compounds were employed. In the last case one of the components was considered the element, of which the content was to be determined, and the second the rest of the compound. The general theory of the method was discussed. (auth)

General Inorganic and Physical Chemistry

22883 CF-60-7-51
Oak Ridge National Lab., Tenn.
SPECTROPHOTOMETRIC STUDIES OF SOLUTIONS AT ELEVATED TEMPERATURES AND PRESSURES: STATUS AND PROGRAM FOR FY-1961 AND PART OF FY-1962. R. E. Biggers and J. M. Chilton. July 19, 1960. 13p. OTS.

A program was initiated on the spectrophotometric study of aqueous solution chemistry. The goal is operation at temperatures up to at least 330°C and at pressures up to 200 atm, and to near the critical point if this appears to be feasible. A spectrometer capable of operation under these extreme conditions is being designed. (W.L.H.)

22884 NAA-SR-869
North American Aviation, Inc., Downey, Calif.
PREPARATION OF A THORIUM SLURRY. L. Silverman and K. Trego. Jan. 7, 1954. Decl. Mar. 16, 1957. 14p. Contract AT-11-1-GEN-8. OTS.

Methods for preparing a fluid containing 1 g/ml of thorium which involved solutions of thorium salts, suspensions of dry solids in water, and colloidal suspensions are discussed. Thorium oxide, oxalate, and fluoride were tried in conjunction with one or more surface actants, but it was not possible to attain the required thorium concentration. Thorium hydrosol, produced by peptization of thorium hydroxide and subsequent electrodialysis, gave the necessary concentration of 1 g/ml. A solution of 0.5 g/ml was found to be stable to electron irradiation and did not flocculate upon shaking or standing. Selected surface actants which might be used as protective colloids were found to be unstable to electron irradiation. (auth)

22885 NEI-77(Rev. 2)
Atomic Energy of Canada Ltd., Chalk River, Ont.
TABLES OF PROPERTIES OF HEAVY WATER AT SATURATION TEMPERATURES. J. Howieson. July 1960. 5p. (AECL-1055). AECL.

Data resulting from conversion of Whalley's results (E. Whalley, The Thermodynamic and Transport Properties of Heavy Water, in Proceedings and Communications of the Conference on Thermodynamic and Transport Properties of Fluids, London, July 10, 1957, sponsored by Inst. Mech. Engrs. (London) and Intern. Union Pure and Appl. Chem. to engineering units are presented. Improvements over the original version were made by means of a computer program to fit the saturated-vapor enthalpy and the latent heat to a sixth-degree polynomial. (J.R.D.)

22886 TID-6244
Ohio Univ., Athens.
TECHNICAL PROGRESS REPORT [FOR] 1959–1960. James Y. Tong. 16p. Contract AT(11-1)-687. OTS.

An analysis of the problems involved in the determination of the first and second dissociation constants of H_2CrO_4 was made. Spectrophotometric measurements were made and compared to calculated values for 25 and 45°C. (C.J.G.)

22887 TID-6289
Indiana. Univ., Bloomington.
STUDY OF INORGANIC SALTS AT HIGH TEMPERATURES. Final Technical Report. Ralph L. Seifert. July 1, 1960. 65p. Contract AT(11-1)-410. OTS.

Results of investigations on the vapor pressures of KCl–CdCl, and KCl–ZrCl systems are presented. Results of surface tension studies on molten CaCl–KCl and CaCl–CsCl solutions are also presented along with results from a study of the effect of iodine on the oxidation rate of aluminum. (J.R.D.)

22888 TID-6348
Michigan. Univ., Ann Arbor.
THERMODYNAMICS OF THE MONOHYDROGEN DIFLUORIDES. II. HEAT CAPACITIES OF LITHIUM AND SODIUM MONOHYDROGEN DIFLUORIDES FROM 6 TO

305°K (thesis). Edgar F. Westrum, Jr. and Glenn A. Burney. [1960?]. 25p. Contract [AT(11-1)-70]. OTS.

The meager quantitative thermodynamic data on the hydrofluorides are augmented by low temperature thermal measurements made by an adiabatic calorimetric technique. Apparent anomalies over the range 202 to 227°K in $NaHF_2$ involving only 11 cal/mole are caused by the presence of traces of higher hydrogen fluorides. The heat capacity (C_p), entropy (S°), free energy function ($[F°-H_0^\circ]/T$), and enthalpy increment ($H°-H_0^\circ$) at 298.15°K are: 16.77 and 17.93 cal/(deg mole), 16.97 and 21.73 cal/(deg mole), −7.49 and −10.54 cal/(deg mole), and 2826 and 3334 cal/mole, for $LiHF_2$ and $NaHF_2$, respectively. The dissociation pressure of $LiHF_2$ was determined from 25 to 115°C, and yielded a heat of decomposition of 13.7 kcal/mole and a standard free energy of formation of −208.1 kcal/mole at 298.15°K. (auth)

22889 JPRS-3517

PRODUCTION OF METALLIC POTASSIUM BY THE VACUUM-THERMIC METHOD. A. Yu. Tayts and V. M. Chel'tsov. Translated from Khim. Prom., No. 5, 404-8 (1959). 10p. OTS.

Experiments in which metallic potassium was prepared by reduction of potassium chloride in vacuum reactions with ferrosilicon or aluminum-silicon are described. The reduction process with ferrosilicon in which a 5% addition of calcium fluoride was used gave a yield of 47 to 63% potassium, whereas the yield for the aluminum-silicon reaction was 39 to 59% on the basis of charge weight to yield weight. The fluoride additive was also beneficial in the aluminum-silicon reduction, but not to the degree which was observed in the ferrosilicon reaction. (J.R.D.)

22890 JPRS-5191

SEPARATION AND INVESTIGATION OF THE PHYSICO-CHEMICAL PROPERTIES OF PLUTONYL CHLORIDE. I. F. Alenchikova, L. L. Zaitseva (Zaytseva), L. V. Lipis, and V. V. Fomin. Translated from Zhur. Neorg. Khim. 4, 961-2(1959). 7p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 4308.

22891 JPRS-5192

SIMPLE AND COMPLEX CARBONATE COMPOUNDS OF PLUTONIUM. A. D. Gel'man and L. M. Zaitsev (Zaytsev). Translated from Zhur. Neorg. Khim. 4, 2688-96(1959). 23p. OTS.

Pu(IV) was precipitated in the solid state from carbonate solutions as the tetracarbonate, pentacarbonate, and hexacarbonate of ammonium Pu compounds. For the compound $(NH_4)_4[Pu(Co_3)_4] \cdot 4H_2O$, the molecular conductivity in aqueous solutions and the apparent molecular weight were determined. It was found that under conditions promoting hydrolysis, oxycarbonate compounds of Pu were formed. Decomposition processes of complex Pu carbonates were studied. (C.J.G.)

22892

INVESTIGATIONS ON THERMAL CONDUCTIVITY CELLS WITH RESPECT TO THEIR APPLICATION TO ISOTOPE ANALYSIS. R. Bucur, I. Mercea, and V. Mercea. Acad. rép. populaire Roumaine, Rev. phys. 5, 5-22(1960). (In Rumanian)

A common method for the analysis of gas mixtures and gaseous isotopes is based on thermal conductivity. A systematic investigation was made for the purpose of increasing the sensitivity of this method by a suitable cell and a suitable selection of the operating conditions. With increased sensitivity the method can be used for isotopic analysis by application of a common electrical apparatus. The principle of the method was summarized, and the apparatus used was described. The results obtained on the sensitivity and the stability conditions were discussed. The possibilities of applying the method to isotopic analysis were considered. (J.S.R.)

22893

INVESTIGATIONS ON THE PRECIPITATION OF AMMONIUM URANATES. II. EFFECT OF AMMONIA ON URANYL IODIDE. C. Drăgulescu and I. Julean. Acad. rep. populare Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări, Ştiinţe chim. 6, No. 3/4, 33-42(1959) July-Dec. (In Rumanian)

The composition of the precipitate formed in the reaction between uranyl iodide and ammonia was established by chemical analysis and by potentiometric and conductometric methods. The results obtained show that a uranium hydroxide with the composition $3\ UO_2 \cdot 5\ H_2O$ is formed initially. This compound in the presence of excess ammonia is transformed into $(NH_4)_2U_8O_{25}$. The treatment of uranyl iodide with dimethylamine and diethylamine yields $(NH_2(CH_3)_2)_2U_{12}O_{37}$ and $(NH_2(C_2H_5)_2)_2U_{16}O_{49}$, respectively. (tr-auth)

22894

MECHANISM OF HYDROGEN−DEUTERIUM EXCHANGE ON ZINC OXIDE CATALYST. A. Krause (Uniwersytet Im. A. Mickiewicza, Poznan, Poland). Bull. acad. polon. sci., Ser. sci., chim. 8, 207-8(1960). (In German)

The appearance of OH or OD groups at the start of the H−D exchange reaction on ZnO was recognized to be important in explaining the reaction. A mechanism which verifies this fact is offered. An R-Zn-O-radical reacts with H_2 or D_2 to produce H and D which can lead to HD molecules. The zinc hydroxide from this reaction decomposes to form more R-Zn-O. (T.R.H.)

22895

THE KINETICS AND MECHANISM OF THE REACTION OF CERIUM(IV) AND CHROMIUM(III). James Ying-peh Tong and Edward L. King (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 82, 3805-9(1960) Aug. 5.

In acidic aqueous sulfate media, the rate law for the oxidation of chromium(III) by cerium(IV) was found to be $d[Cr^{VI}]/dt = k[Ce^{IV}]^2[Cr^{III}]/[Ce^{III}]$. This rate law indicates that the transition state for the reaction contains one cerium atom and one chromium atom with an average oxidation state for the two metal atoms of +4. A reasonable mechanism consistent with this involves a rate-determining reaction of cerium(IV) with chromium(IV), the concentration of which is determined in a relatively rapid equilibrium with chromium(III), cerium(IV) and cerium(III). The empirical rate coefficient k shows an approximately inverse square dependence upon the concentration of bisulfate ion. (auth)

22896

KINETICS OF THE Co(II)aq.−Co(III)aq. ISOTOPIC EXCHANGE REACTION. N. A. Bonner and J. P. Hunt (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc. 82, 3826-8(1960) Aug. 5.

Additional data are presented on the Co(II)aq.−Co(III)aq. exchange reaction. The experimental activation energy in 1 f $HClO_4$ is 13.2 kcal/mole and the entropy of activation is −13 e.u. A shiny Pt foil surface did not affect the rate. Removal of O_2 from the solutions also produced no change in the rate. The over-all rate is ca. one-half as fast in 95% D_2O as in H_2O. Increasing ionic strength appears to increase the reaction rate. There seem to be specific effects due to changing anions from ClO_4^- to NO_3^- or HSO_4^-. The effect of changing (H^+) at constant ionic strength appears to be consistent with either a rate law of the form rate = $(Co(II))(Co(III))[k_1 + k_2/(H^+)]$ or with a linear variation of the logarithm of the activity coefficient function with fraction of $HClO_4$ in $HClO_4-NaClO_4$ mixtures. The relative slowness of the ammino system compared to the aquo case appears to be the result of a more negative entropy of activation for the former. (auth)

22897

ON THE REACTIVITY OF URANOURANIC OXIDE [PART] III. Rokuo Ukazi (Osaka Metal Ind. Co., Yodogawa Works). J. Atomic Energy Soc. Japan 2, 389-93(1960) July. (In Japanese)

The change of specific surface area by heat treatment in the range of 700 to 1,200°C was measured for uranouranic oxides, U_3O_8 I, II, and III, which were prepared from uranyl nitrate, ammonium diuranate, and uranium peroxide, respectively. The influence of the change of the specific surface area on the reactivity of these oxides was also studied. The Poiseuille flow area and the Knudsen flow area at the steady state and the transient state were applied for measuring the specific surface area of U_3O_8. The reactivity was expressed by the rate of reduction. The results were as follows: (1) Generally speaking, the specific surface area decreased at an appreciable rate above 650°C and in the decrease became negligible above 900°C. (2) The change of the specific surface area had appreciable influence on the reactivity of U_3O_8 I, II, and III, although some other factors might have some influence on U_3O_8 II and III. (auth)

22898

DIFFUSION OF LITHIUM THROUGH TUNGSTEN. G. M. McCracken and H. M. Love (Queen's Univ., Kingston, Ont.). Phys. Rev. Letters 5, 201-2(1960) Sept. 1.

The diffusion coefficients of Li^7 and Li^6 in tungsten were measured on tungsten ribbon with Li deposited on one side; the Li atoms diffusing to the other side were identified by a mass spectrometer as a function of time. For the equation $D = D_0 \exp(-\epsilon/kT)$, a plot of the Li^7 data on a D vs 1/T graph gives $\epsilon = 2.42 \pm 0.05$ ev and $D_0 = 82 \pm 40$ cm^2 sec^{-1}, and comparison of Li^7 and Li^6 data gives $D_6D_7 = 1.07 \pm 0.02$, which is in good agreement with $(M_7M_6)^{1/2} = 1.080$. The diffusion is through the lattice rather than through the grain boundary or surface. (D.L.C.)

22899

ELECTROCHEMICAL METHODS OF PRODUCING EXPERIMENTAL FIELD EMISSION EMITTERS OF DIFFERENT SHAPE FROM ZIRCONIUM, GERMANIUM AND TUNGSTEN CARBIDES. N. M. Alpatova. Radiotekh. i Elektron. 5, 1351-5(1960) Aug. (In Russian)

Various electrochemical methods (of etching, polishing, and oxidation) of preparing experimental field emission sources from zirconium, germanium, and tungsten carbides are discussed. (R.V.J.)

22900

A NEW REDUCING AGENT: REDUCTION OF VANADIUM^{IV} AND URANIUM^{VI} WITH FERROUS ION IN CATECHOL SOLUTIONS. John W. Miller (Phillips Petroleum Co., Bartlesville, Okla.). Talanta 4, 292-3(1960) June.

When a ferrous solution is added to an ammoniacal solution of either the vanadyl- or uranyl-catechol complex with excess catechol, V^{4+} and U^{6+} are reduced rapidly to V^{3+} and U^{4+}, respectively. Polarographic data on the ferrous-catechol/ferric-catechol couple in ammoniacal solution (pH 9.5) indicate that its reduction potential is −0.97 volt vs. Ag/AgCl, and ferrous-catechol in a degassed solution will reduce water. The strong reducing power of ferrous-catechol is attributed to the high stability of the ferric-catechol complex compared with the ferrous complex. Ferrous-catechol can be used as a reducing titrant, and potentiometric titrations were carried out on solutions of VO^{2+}, V^{5+}, and UO_2^{2+}, giving errors <0.5%. Since V^{4+} and U^{6+} mixtures cannot be differentiated in a titration, they must be separated prior to titration. Molybdate-catechol is also reduced by ferrous-catechol. (D.L.C.)

22901

THE EQUIVALENT CONDUCTANCE OF ELECTROLYTES IN MIXED SOLVENTS. VI. URANYL CHLORIDE IN THE WATER—ETHANOL SYSTEM. Neal Goldenberg and Edward S. Amis (Univ. of Arkansas, Fayetteville). Z. physik. Chem. (Frankfurt) (N. S.) 22, 63-80(1959) Oct. (In English)

Measurement of the conductance of uranyl chloride in the concentration range from $5 \cdot 10^{-3}$ to $2 \cdot 10^{-4}$ equivalents per liter at temperatures of 25.00, 35.00, and 45.00°C was made in pure water, and in mixtures of approximately 20, 40, 60, 80, and 97 wt.% ethanol. The equivalent conductance at infinite dilution (Λ_0) for each of the solvents at each temperature was obtained by graphical extrapolation of the data. The equilibrium constant (K) for the ion pair dissociation of the uranyl chloride in each solvent at each temperature was obtained from the same extrapolation of the data. In water solutions the conductance of the uranyl chloride was corrected for the conductance of the hydrogen ion at each concentration. The dependence of Λ_0 and of K upon temperature, viscosity, composition, and dielectric constant is discussed. (auth)

22902

RADIOCHEMICAL STUDY OF THE PARTIAL PROCESS OF BARIUM SULFATE PRECIPITATION. I. DESCRIPTION OF METHOD AND EXPERIMENTAL PART. K. H. Lieser and A. Fabrikanos (Technische Hochschule, Darmstadt, Ger.). Z. physik. Chem. (Frankfurt) (N. S.) 22, 246-77 (1959) Nov. (In German)

To gain insight into the partial process of barium sulfate precipitation, a radiochemical method was developed. The principle on which the method is based involves the addition of carrier-free Ba^{140} in radiochemical equilibrium with La^{140} before precipitation at different times after the beginning of precipitation. After the beginning of precipitation or after the addition of Ba^{140}, samples of the solution were taken (without precipitate) at short-time intervals with a specially designed apparatus and measured. From the changes in specific activity of the solution, relations were derived for calculation of the total surface of the crystals, average particle size, and material exchange between solution and precipitate during the precipitation process. By using 0.01 or 0.002 M solutions, four series of measurements were made (equivalent precipitate, Ba precipitate with larger and smaller excesses of Ba ions, and sulfate precipitate). The presence of a small, definite excess of Ba ions was found to be advantageous for quantitative evaluations. (tr-auth)

22903

RADIOCHEMICAL STUDY OF THE PARTIAL PROCESS OF BARIUM SULFATE PRECIPITATION. II. DISCUSSION OF MEASUREMENT RESULTS. K. H. Lieser and A. Fabrikanos (Technische Hochschule, Darmstadt, Ger.). Z. physik. Chem. (Frankfurt) (N. S.) 22, 278-91(1959) Nov. (In German)

From the results of the radiochemical measurements during $BaSO_4$ precipitation with 0.01 M solutions, calculations were made of the supersaturation of the solution, the quantity of precipitate, total surface of crystals, average particle size, and the material exchange between solution and precipitate as a function of time. The total crystalline surface reaches a maximum shortly after precipitation begins, drops steeply within 10 minutes, and then remains constant. The decrease in surface is produced by aging. A greater proportion of precipitate is brought down during the aging in solution and further separated. The aging proceeds according to Ostwald's Mechanism. The kinetics of the crystal growth, aging, and isotope exchange is determined in the same way by the surface reactions at the crystal-solution interface. The aging joins with a slow process which produces a recrystallization in the solution. From isotopic exchange a value of 5.6×10^4 cm^2/g results for the specific surface of the $BaSO_4$ precipitated with equivalent quantities of 0.01 M solutions after completion of precipitation. (tr-auth)

22904

RADIOCHEMICAL STUDY OF THE PARTIAL PROCESS OF BARIUM SULFATE PRECIPITATION. III. COPRECIPITATION WITH CARRIER-FREE LANTHANUM. K. H. Lieser and A. Fabrikanos (Technische Hochschule, Darmstadt, Ger.). Z. physik. Chem. (Frankfurt) (N. S.) 22, 398-405(1959) Nov. (In German)

Carrier-free La^{140} can be detected in $BaSO_4$ precipitation as a typical example of a nonisotopic, chemically-foreign microcomponent. The coprecipitated La can be separated into two types. The first type is enclosed in the $BaSO_4$ precipitate and the second is adsorbed on the surface of the $BaSO_4$. In the case of La ions, equal material exchange between precipitate and solution is observed as in the case of Ba ions. A part of the enclosed La is again separated from the precipitate in aging. (tr-auth)

22905

RADIOCHEMICAL STUDY OF THE PARTIAL PROCESS OF BARIUM SULFATE PRECIPITATION. IV. COMPARISON OF CONDUCTIVITY MEASUREMENTS AND RADIOCHEMICAL MEASUREMENTS. K. H. Lieser and A. Fabrikanos (Technische Hochschule, Darmstadt, Ger.). Z. physik. Chem. (Frankfurt) (N. S.) 22, 406-16(1959) Nov. (In German)

For the completion of radiochemical measurements, conductivity measurements were made at different concentrations during the $BaSO_4$ precipitation. After a short starting time, a faster and then a slower process is observable. Both processes follow a first-order rate law. They are characterized by their half life times. Both reactions are determined, not through diffusion in the solution, but through surface reactions at the crystal–solution interface. The fast process is the crystal growth, the slow process is the Ostwald aging. Advantages and disadvantages of the conductivity measurements and the radiochemical measurements are compared; both research methods worked well. (tr-auth)

22906

HEAT CAPACITY OF UF_4 AT 100 TO 400°C. G. L. Gal'chenko, Yu. V. Gagarinskii, and M. M. Popov. Zhur. Neorg. Khim. 5, 1631(1960) July. (In Russian)

A sample of $UF_4 \cdot 2.5H_2O$ with less than 2 % UO_2F_2 was dehydrated by gradually raising the temperature to 225°C, and it was found that an unstable anhydrous form of UF_4 is formed under these conditions which has a distinctly higher heat capacity than that found for UF_4 samples heated to 270 to 370°C. X-ray analysis shows that UF_4 samples heated to 350°C acquire a stable monoclinic structure and have a lower heat capacity than the unstable form of UF_4 obtained by dehydration at 225°C or lower. (TTT)

22907

INTERACTION OF $NbCl_5$ AND $TaCl_5$ WITH $PSCl_3$. L. A. Nisel'son. Zhur. Neorg. Khim. 5, 1634(1960) July. (In Russian)

$TaCl_5$ and $NbCl_5$ form a eutectic-like system with $PSCl_3$ that is similar to the one that these pentachlorides form with $TiCl_4$. Over a wide range of concentrations the log of the molar concentrations of $NbCl_5$ and $TaCl_5$ is a linear function of 1/T, where T is the absolute temperature of fusion of the pentachloride with $PSCl_3$. The crystals which separate from the $PSCl_3$ solution were shown to be pure $TaCl_5$ or $NbCl_5$ by chemical analysis. Hence, there is no chemical reaction of these pentachlorides with $PSCl_3$. Since $NbCl_5$ and $TaCl_5$ react with $PoCl_3$ to form $NbCl_5 \cdot PoCl_3$ and $TaCl_5 \cdot PoCl_3$, respectively, it is assumed that chemical bonding of the metal atom with phosphorous takes place through an oxygen link. (TTT)

22908

HALIDES OF THE ACTINIDE ELEMENTS. Joseph J. Katz and Irving Sheft (Argonne National Lab., Ill.). p.195-236 of "Advances in Inorganic Chemistry and Radiochemistry." Volume 2. H. J. Emeleus and A. G. Sharpe, eds. New York, Academic Press Inc., 1960.

The review is confined to the solid binary halides. Principal attention is focused on developments which have occurred since the subject was last reviewed in 1957. 90 references are cited. (B.O.G.)

Radiation Chemistry and Radiochemistry

22909 AERE-R-3194

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

TEMPERATURE EFFECTS ON THE RADIATION INDUCED REACTION OF CARBON DIOXIDE WITH GRAPHITE. H. B. F. Gow and W. R. Marsh. May 1960. 28p. BIS.

In a study of radioinduced graphite–CO_2 reaction at 100 to 650°C it was found that below 600°C the production of CO is affected only slightly; however, at 650°C an increased rate is observed. It is suggested that thermal decomposition of surface oxide takes place at this temperature. (auth)

22910 ARF-1145-4

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

RADIATION INDUCED FLUORINATION OF NITROCOMPOUNDS. Final Summary Report Covering the Period from June 1, 1959 to May 31, 1960. P. Y. Feng. July 29, 1960. 20p. Contract DA-11-022-ORD-3046.

A summary of activities in a program to demonstrate the feasibility of radioinduced fluorination of nitro-aromatics is presented. Carbon tetrafluoride/nitrobenzene ratios ranging from 0.019 to 4.67 were used to demonstrate such feasibility. Dose rates of 10^4 to 10^6 r/hr for total dosages of 10^6 to 10^8 r and temperatures at room temperature to 200°C were used. Results are discussed and presented graphically. (J.R.D.)

22911 BNL-4908

Brookhaven National Lab., Upton, N. Y.

RADIOISOTOPIC COWS. Walter D. Tucker. [1960]. 10p. OTS.

Methods are being developed for producing radioisotopes which would be useful if they were available, or available in a suitable and convenient form. The development of "radioisotopic cows" was one emphasized part of this effort. The present "herd" includes $Sr^{90}-Y^{90}$, $Te^{132}-I^{132}$, and $Mo^{99}-Tc^{99m}$ units. The design, operation, and possible application are discussed. (auth)

22912 NAA-SR-4961
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
THE RADIOLYSIS OF DEUTERATED BIPHENYLS: MECHANISM OF HYDROGEN FORMATION. J. G. Burr and J. M. Scarborough. July 30, 1960. 29p. Contract AT-11-1-GEN-8. OTS.

General characteristics of the radiation chemistry of aromatic hydrocarbons are summarized. The values of G(hydrogen), G(H), G(D) are reported, as well as the $H_2/HD/D_2$ ratios observed in the radiolysis with cobalt-60 gamma rays of biphenyl, biphenyl-4, 4′-d_2, biphenyl-2, 2′, 6, 6′-d_4, biphenyl-3, 3′, 5, 5′-d_4, biphenyl-2, 2′, 4, 4′, 6, 6′-d_6, biphenyl-2, 2′, 3, 3′, 5, 5′, 6, 6′-d_8, and biphenyl-d_{10}. (auth)

22913 TID-6260
Western Reserve Univ., Cleveland.
TECHNICAL PROGRESS REPORT [FOR] JUNE 16, 1959 TO JUNE 16, 1960. R. F. Firestone. June 27, 1960. 15p. Contract AT(11-1)-685. OTS.

Investigations of the Co^{60} gamma-ray-induced decomposition of CCl_4 were continued. Recent work on the Co^{60} gamma-ray-induced decomposition of CCl_2Br_2 was concentrated upon investigations of the effects of phase, temperature, and additives. Further work is reported on the radiolysis of chloroform. Investigations of the effects of temperature and dosage on the extent of decomposition of N-pentane are presented. The radiolysis of gaseous methane and the kinetics of thermal exchange between D atoms and CH_4 are being investigated. (W.L.H.)

22914 WAPD-T-1113
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
USE OF RADIOCHEMISTRY AND MASS SPECTROMETRY FOR FUEL DEPLETION STUDIES. J. E. Hudgens. 1960. 14p. Contract AT-11-1-GEN-14. OTS.

Presented at the ASTM Annual Meeting June 29—July 1, 1960, Atlantic City, New Jersey.

Mass spectrometers designed for isotopic analyses on small samples of reactor fuels were used for fuel depletion studies. The design details of these instruments and the mathematical basis for data treatment are described. Studies were performed utilizing radiochemical methods for fuel-depletion determinations. Gamma ray spectrometry and radiochemical separations were used to determine the total number of fissions induced in irradiated specimens. By combining radiochemical and mass spectrometric techniques a description of the isotopic changes in fuel specimens was obtained. (auth)

22915 CEA-tr-R-315
EFFECTS CHIMIQUES DE LA REACTION (γ,n). (Chemical Effects of the (γ,n) Reaction). A. N. Murin (Mourine), V. D. Nefedov, V. I. Baranovskiĭ, and D. K. Popov. Translated into French from Uspekhi Khim. 26, 164-75(1957). 33p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 5807.

22916 UCRL-Trans-545
THE PHOTOCHEMICAL FORMATION OF CARBON TETRACHLORIDE FROM CHLOROFORM AND CHLORINE. Hans-Joachim Schumacher and Kurt Wolff. Translated from Z. physik. Chem. (Leipzig) 25B, 161-76(1934). 14p. JCL

The photochemical formation of carbon tetrachloride from chloroform and chlorine in the gas phase was investigated between 50 and 70°C. A rate law was found that represents the total reaction, and a reaction scheme was given that readily yields this law. The individual reactions are discussed and their rate constants calculated. (auth)

22917
SIMPLE TRITIATION OF ORGANIC COMPOUNDS. A. Wacker and L. Träger (Universität, Berlin). Angew. Chem. 72, 168-9(1960) Mar. 7. (In German)

In a glass apparatus, tritium is absorbed on uranium and desorbed without danger. Thus, the technique can be used for tritium labelling according to the Wilzbach Procedure. (T.R.H.)

22918
RADIOCHEMICAL RESEARCH ON THE PRODUCTION OF PURE ANTIMONY METAL. W. Gebauhr and A. Spang (Siemens-Schuckertwerke A. G., Erlangen, Ger.). Angew. Chem. 72, 345-8(1960) May 21. (In German)

The purification of antimony according to a modified Groschuff procedure was observed by means of radionuclides. The shifting of concentrations was to some extent not only unexpected, but it was also shown that in some processing steps the concentrations of foreign metals are not decreased, but increased. (auth)

22919
GREY-WEDGE SPECTROSCOPY AS A NEW AID IN RADIOCHEMISTRY. J. Schulz (Telefunke G.m.b.H., Ulm, Ger.). Chem.-Ingr.-Tech. 32, 453-4(1960) July. (In German)

The principle and mode of operation of grey-wedge spectroscopy are described. This technique is especially suited for investigation of isotopes with short half lives and with weak radiations. (T.R.H.)

22920
THE EFFECT OF SOLIDS ON THE DECOMPOSITION OF CCl_4 IN AN AQUEOUS SOLUTION UNDER THE ACTION OF γ-RAYS. A. S. Baberkin, N. P. Krushinskaya, and M. A. Proscurnin. Doklady Akad. Nauk S.S.S.R. 132, 1329-31 (1960) July 21. (In Russian)

The effects of solids on the decomposition of CCl_4 in water (with the ratio 1 : 2) were studied with carbolen, silicagel, Al_2O_3, Fe_2O_3, and Cu_2O (varying from 1.4 to 20 wt.%) exposed to γ radiation from Co^{60} to a dose of 4×10^{16} ev/sec at 8 to 10°C. The plotted curves show an increase of Cl^- ion concentration with the presence of 1.4% of silicagel and a continuous (not proportional) increase of Cl^- ions with the increase of silicagel concentrations. The ability of other solids to increase the ion yield is exhibited in the following sequence: $Al_2O_3 > SiO_2 > Fe_2O_3 >$ coal $> Cu_2O$. It was found that oxygen does not participate in CCl_4 dissociation. The data indicate that the presence of oxygen and solid catalyst is necessary for increased radiolysis yield. (R.V.J.)

22921
IONIC POLYMERIZATION OF STYRENE IN METHYLENE DICHLORIDE BY IONIZING RADIATION. Seizo Okamura and Shigeru Futami (Kyoto Univ.). Intern. J. Appl. Radiation and Isotopes 8, 46-51(1960) May. (In English)

Styrene was polymerized in methylene dichloride (homogeneous phase) by the irradiation of Co^{60} γ rays at −78°C. The polymerization rate measured was about two hundred times higher than the calculated radical polymerization rate at the same temperature. No oxygen effect was found. Addition of some organic compounds into the polymerization system showed the ionic character of the polymerization mechanism. The rate of polymerization increased proportionally with styrene concentration up to 1.5 mol/l and had linear dependence on the dose rate. The γ ray induced copolymerization analysis of a 1 : 1 mixture of styrene and methyl methacrylate and a 3:1 mixture of styrene and p-methoxystyrene which showed the cationic polymerization mechanism at low temperature. The polymerization mechanism that explains semi-quantitatively the experimental results was proposed. (auth)

22922

RADIOLYTIC REDUCTION OF TETRAVALENT CERIUM AT DOSE OUTPUTS OF UP TO 10^{23} ev/ml-sec. A. K. Pikaev and P. Ya. Glazunov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 5, 940-2(1960) May.

G(Ce^{3+}) values, ions per 100 ev, were obtained by irradiating 2×10^{-4} N ceric sulfate solutions in 0.8 N H_2SO_4 with 0.8 Mev electrons. The duration of the burst of electrons used to irradiate the solution was 5×10^{-6} seconds and the integral dose per burst varied from 5×10^{16} to 3×10^{17} ev/ml, which corresponds to doses of 1×10^{21} to 6×10^{22} ev/ml-sec. At a dose rate of $\sim 10^{21}$ ev/ml-sec the value of G(Ce^{3+}) rises from 2.44 ions/100 ev to 3.0 ions/100 ev at a dose rate of 5.8×10^{22} ev/ml-sec. It is assumed that there is an overlapping of the tracks of ionizing particles in solution at high dose rates. The value of G(H_2O_2) increases and the values of G(H) and G(OH) decrease. Since G(Ce^{3+}) = G(H) + 2 G(H_2O_2) − G(OH), the value of G(Ce^{3+}) increases at high dose rates. (TTT)

22923

REACTIONS OF HYDROGEN AND HYDROCARBONS WITH IODINE EXCITED BY 1849 Å. RADIATION. Thomas A. Gover and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 82, 3816-21(1960) Aug. 5.

Previous work showed that iodine molecules excited by 1849 A. radiation react with CH_4 to form CH_3I and HI. Similar reactions were found to occur with C_2H_4, C_2H_6, C_4H_{10}, and H_2. There is strong evidence that the I_2-CH_4 system 1849 A. radiation absorbed by the I_2 initiates steps which lead to carbon-carbon bond formation resulting in products such as C_2H_5I, C_3H_7I, C_4H_9I, C_2H_6, and C_3H_8. These products are formed with quantum yields in the range of 10^{-5} to 10^{-3} whereas the yields of the CH_3I and HI are about 5×10^{-2} (assuming a quantum yield of unity for the CH_3I-I_2 exchange activated by 1849 A. light absorbed by CH_3I). The reactions of excited I_2 molecules with hydrocarbons to produce HI and the alkyl iodide appear to occur only on the first collision of an excited iodine molecule with the hydrocarbon. Evidence for this and information on the quenching cross sections was obtained by studying the reaction yields as a function of total pressure. At low pressures the yields are low, increasing to a maximum at pressures where the average time between collisions is small compared to the fluorescence lifetime of the iodine molecule. Incidental to these investigations it was found that the absorbancy index of I_2 at 1849 A. is pressure sensitive, varying from about 10^4 at very low pressures to about 2×10^5 at atmospheric pressure. (auth)

22924

ON THE THERMAL AND RADIATION-INDUCED CHAIN REACTION BETWEEN METHANE AND ETHYLENE. P. J. Lucchesi and W. Bartok (Esso Research and Engineering Co., Linden, N. J.). J. Am. Chem. Soc. 82, 4108-9(1960) Aug. 5.

Radiation-induced reactions between methane and ethylene at high temperatures and pressures were studied. The methane-ethylene mixture was kept under a pressure of 55 atm, the temperature varied from 343° to 426°C, and the absorbed radiation was 0.12×10^6 rad/hr. Thermal experiments showed no conversion in 6 hrs at 343°. In the presence of radiation, the reaction between CH_4 and C_2H_4 gave 3.1% conversion of CH_4 and 27.0% conversion of C_2H_4. The thermal reaction at 426° was accelerated by radiation, but above 426°C the thermal reaction was so rapid that acceleration by radiation was difficult to observe. Work now in progress was designed to obtain detailed product composition versus conversion data for both the thermal and radiation induced reactions. (M.C.G.)

22925

THE PREPARATION OF A VOLATILE POLONIUM FLUORIDE. Bernard Weinstock and Cedric L. Chernick (Argonne National Lab., Ill.). J. Am. Chem. Soc. 82, 4116-17 (1960) Aug. 5.

The formation of PoF_6 with subsequent storage as vapor in the presence of excess F was attempted. Po^{208} was deposited on Pt gage, the gage placed in a Ni tube, and F gas passed through the tube. The change in fast neutron distributions resulting from the formation and decomposition of the volatile PoF_6 was studied. Results indicated that a volatile Po compound was formed which decomposed due to chemical and radioactive decomposition. (M.C.G.)

22926

STUDIES INVOLVING ISOTOPICALLY LABELED FORMIC ACID AND ITS DERIVATIVES. VI. ESTIMATION OF THE RELATIVE IONIZATION CONSTANTS OF FORMIC ACID AND FORMIC-d ACID AT 24.0 ± 0.5°. Gus A. Ropp (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 82, 4252-4 (1960) Aug. 20.

The ratio of the ionization constants of formic acid and formic-d acid (DCOOH) in aqueous solution at 24.0 ± 0.5° was found to be $K_a(H)/(K_a(D)) = 1.06 \pm 0.03$. The value of this secondary equilibrium deuterium isotope effect is not consistent with the suggestion of Halevi that the previously observed secondary deuterium isotope effect in the case of the ionization constant of α,α-dideuteriophenylacetic acid is the result of stronger inductive electron release from C−D than from C−H bonds. (auth)

22927

SOME OBSERVATIONS ON MONOLAYERS OF CARBON-14 LABELED STEARIC ACID. George L. Gaines, Jr. (General Electric Research Lab., Schenectady, N. Y.). J. Colloid Sci. 15, 321-39(1960) Aug.

Films of radiostearic acid were deposited on a variety of solids (Cu, Al, Pt, Cr, mica, and glass), both by transfer from water surfaces and by adsorption from cetane and nitromethane solutions. The concentration of stearic acid in these films was assessed radiometrically, and some observations on removal of the film by benzene rinsing were made. At high surface pressures (>17 dynes/cm), stearic acid monolayers on water are transferred to solids at the same concentration that exists on the water. At lower pressure (10 dynes/cm), lower concentrations are found after transfer. This may be related to the discontinuous structure of the film at this pressure. Adsorption of more than a single monolayer (based on the geometrical area of the surface) occurs with Cu and Al, probably because of soap formation. With inert substrates (Pt, Cr, and mica), adsorption leads to only a fraction of a close-packed monolayer in times up to several hours. These results are discussed in terms of mechanisms of film deposition. Their importance in the Wilhelmy method for surface-pressure measurement is emphasized. (auth)

22928

RADIATION EFFECTS ON DIMETHYL-DIPHENYL SILOXANE COPOLYMER. I. PROTECTIVE EFFECT OF PHENYL RADICAL ON THE CROSS-LINKING. Mitsuru Koike and Akibumi Danno (Japan Atomic Energy Research

Inst., Tokyo). J. Phys. Soc. Japan 15, 1501-8(1960) Aug. (In English)

The radiation effects both of polydimethyl siloxane and dimethyldiphenyl siloxane copolymers were studied by the use of gamma rays of cobalt-60 in order to estimate the protective effect due to phenyl radical against the radiation-induced cross linking. The viscosity of irradiated sample increased with the absorbed dose and finally the sample became gel. The efficiency of cross linking of copolymers is remarkably reduced with increasing concentration of diphenyl siloxane. The minimum absorbed dose for gel formation, the efficiencies of cross linking per monomer unit were obtained as a function of the concentration of phenyl radical. It is estimated that the protective effect of diphenyl siloxane may extend over five or six neighbouring monomers of dimethyl siloxane. (auth)

22929

THE FORMATION OF CARBONYL COMPOUNDS FROM SATURATED FATTY ACIDS BY Co^{60} γ RADIATION. K. Täufel, R. Zimmermann, and R. Huber (Deutsche Akademie der Wissenschaften, Berlin). Naturwissenschaften 47, 355(1960). (In German)

The effect of ionizing radiation on fats was investigated on saturated fatty acids by means of the thiobarbituric acid reaction. The formation of carbonyl compounds by γ radiation was determined as a function of the gas medium and the hydrogen concentration during the irradiation. Irradiation doses from 1×10^4 to 1.5×10^6 r were used. The results showed that with 1.5×10^6 r, carbonyl compounds were formed, especially with the liquid acids (C_4 to C_{10}). The presence of water, especially in high concentrations, increases the carbonyl formation. Carbonyl formation is connected with the presence of oxygen. The addition of α-tocopherol reduces the radioinduced formation of carbonyl in butyric acid. UV radiation of a mercury lamp has the same effect as Co^{60} γ radiation. (J.S.R.)

22930

HYDRAZINE FROM IRRADIATION OF SOLID AND LIQUID AMMONIA. Boris Levy, Lawrence M. Epstein, and George Handler (Westinghouse Electric Corp., Pittsburgh). Nucleonics 18, No. 9, 128; 130(1960) Sept.

Hydrazine was produced with radiation yields of 0.1 to 0.2 molecule per 100 ev by reducing the temperature until ammonia became a liquid or solid. In this study, 2 Mev electrons from a Van de Graaff accelerator were used to irradiate ammonia at room temperature, −77, and −196°C. Three explanations were suggested for the large increase in yield at low temperatures. These were that the high yield resulted from an intermolecular reaction step favored by solid-phase geometry, that the diffusion of hydrogen atoms from the reaction spurs was highly favored over that of other species at low temperatures, and that hydrazine was destroyed by a back reaction involving H-radical attack at room temperatures. (M.C.G.)

22931

NEUTRON IRRADIATION OF ORGANIC MOLECULE CONTAINING THREE NITROGEN ATOMS. Yutaka G. Tanaka and Yoshiyuki Asami. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 54, 150-4(1960) Mar. (In English)

The consequence of nuclear recoil in organic molecules, containing three nitrogen atoms, 2, 4, 6-trioxohexahydrotriazine, irradiated with neutrons in an atomic pile was discussed. Separations of three re-entry products, 2, 4, 6-trioxohexahydropyrimidine-5-^{14}C, 2, 4, 6-trioxypyridine-3, 5-$^{14}C_2$, and 2, 4, 6-trioxybenzene-1, 3, 5-$^{14}C_3$ from the mother compound, assays of their radiochemical yields, and determinations of labeled situations on their molecules were described. (auth)

22932

THE RADIATION CHEMISTRY OF OXYCHLORINE COMPOUNDS. I. THE ACTION OF X-RAYS ON AQUEOUS SOLUTIONS OF SODIUM CHLORITE. L. T. Bugaenko, E. P. Kalyazin, and N. A. Bakh (Moscow State Univ.). Zhur. Fiz. Khim. 34, 1243-9(1960) June. (In Russian)

The effects of 65 kv peak x rays on 10^{-3} M aqueous $NaClO_2$ solutions were investigated. In solutions saturated with nitrogen and with hydrogen, oxidation of the ClO_2^- ion to ClO_2 and ClO_3^- ion as well as reduction to ClO^- and Cl^- ions takes place. Hydrogen peroxide appears only after the ClO^- ions are completely decomposed. G values depend upon the amount of energy absorbed. In oxygen saturated solution the yields of chlorite oxidation and reduction products have much lower values. In this case hypochlorite does not appear and hydrogen peroxide forms from the beginning of the irradiation. A mechanism was proposed in which ClO_2 is considered as an intermediate in the oxidation of ClO_2^- to ClO_3^- and ClO and ClO^- as intermediates in the reduction of ClO_2^- to Cl^-. (auth)

22933

MASS SPECTROMETRY IN NUCLEAR CHEMISTRY. H. G. Thode, C. C. McMullen, and K. Fritze (McMaster Univ., Hamilton, Ont.). p.315-63 of "Advances in Inorganic Chemistry and Radiochemistry." Volume 2. H. J. Emeleus and A. G. Sharpe, eds. New York, Academic Press Inc., 1960.

Important developments in nuclear chemistry in which mass spectrometers have played a role are reviewed. In all the applications sensitive instruments are required for the determination of isotope abundances. In this connection the conventional ionic-type mass spectrometer is used almost exclusively for the determination of absolute and relative isotope abundances with the exception of the wide use of infrared methods for the determination of hydrogen to deuterium rations. 126 references are cited. (B.O.G.)

22934

METHOD FOR CROSS-LINKING POLYMERS OF HYDROCARBON OLEFINES. (to Dow Chemical Co.). British Patent 844,231. Aug. 10, 1960.

Procedures and data are presented for radioinduced crosslinking of mixtures of ethylene and propylene polymers with polyfunctional monomers. It is possible to fabricate the mixtures into a desired shape or structure prior to crosslinking with radiation. Excellent results may be obtained with the following polyfunctional monomers: divinyl benzene (DVB), mono-, tri-, and tetraethylene glycol dimethacrylate, allyl acrylate and methacrylate, vinyl methacrylate, and diallyl maleate. The quantity of the monomer in the mixture depends on both the nature of the polymer and the desired properties of the final product; generally, it is between 1 and 40 (or 5 and 25) wt.%. The radiation may be β, γ, or x radiation, but the field intensity should be at least 4×10^4 r/hr with total doses smaller than that necessary for crosslinking in the polymer alone. When the polymer is branched polythene, the mixture can be irradiated at <3-Mrep doses; for linear, unbranched polyethylene, the dose should be <10 Mrep; and for polypropylene, the dose should be <25 Mrep. Several experiments were made on the solubility and insoluble gel-formation of polyethylene in solvents under various conditions of the above crosslinking method with DVB as the monomer in most of the experiments. The mechanical properties of crosslinked polyethylene-DVB mixtures were studied together with the crosslinking ability of various monomers present at 20 wt.% concentrations in polyethylene mixtures. (D.L.C.)

22935

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION

OF POLYMER COMPOSITIONS. Ernest Gordon Cockbain, Thomas David Pendle, and Derek Terence Turner (to British Rubber Producers' Research Ass'n.). British Patent 844,791. Aug. 17, 1960.

If certain olefinic monomers are polymerized by high-energy radiation in the presence of aqueous dispersions of natural rubbers, polymers with novel and potentially useful properties can be obtained. For example, the product from the Co^{60} γ-induced polymerization of methyl methacrylate and Hevea latex has better film-forming properties than that from peroxide-induced polymerization of the same reactants. The olefinic monomer can also be one of the vinyl compounds and conjugated dienes, and the natural-rubber dispersions may contain a colloidizing surface-active agent that can aid in polymerizations. (D.L.C.)

Raw Materials and Feed Materials

22936 CF-53-2-255
Oak Ridge National Lab., Tenn.
CONVERSION OF $UO_2(NO_3)_2$ TO UF_4 BY ION EXCHANGE AND ELECTROLYSIS. Quarterly Report for November 10, 1952—February 10, 1953. I. R. Higgins and J. T. Roberts. Decl. Mar. 15, 1960. 19p. OTS.

A study of alternate processes for converting $UO_2(NO_3)_2$ to UF_4 was conducted. Lowered costs and improved product quality were emphasized in production of the fluoride from which UF_6 or uranium metal can be prepared. (For preceding period see CF-53-2-210). (J.R.D.)

22937 CF-55-9-51
Oak Ridge National Lab., Tenn.
PRELIMINARY ECONOMIC EVALUATION OF THE FLUOROX PROCESS FOR MANUFACTURING UF_4 AND UF_6. J. E. Moore. Sept. 14, 1955. Decl. Apr. 28, 1960. 16p. Contract W-7405-eng-26. OTS.

Process flow diagrams, process-equipment descriptions, and a preliminary economic evaluation of the Fluorox Process are presented. (See also CF-55-5-176.). (C.W.H.)

22938 HW-34313(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONTINUOUS DENITRATION—DESIGN SPECIFICATION LETTER NO. 1. M. J. Szulinski and R. G. Geier. Jan. 4, 1955. Decl. June 10, 1960. 6p. Contract W-31-109-Eng-52. OTS.

Design and technical specifications are outlined for equipment designed for the continuous calcination of UNH to UO_3. (C.W.H.)

22939 HW-34470(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONTINUOUS DENITRATION—STATUS OF DEVELOPMENT, JANUARY 12, 1955. M. J. Szulinski. Jan. 14, 1955. Decl. June 10, 1960. 9p. Contract W-31-109-Eng-52. OTS.

The results of studies on a semi-plant scale calciner are summarized. The amount of UO_3 produced after 310 hr operation of the reactor is given. The oxide produced was relatively coarse, dense, and free flowing. The reactivity to subsequent reduction and hydrofluorination of the UO_3 produced is given. (W.L.H.)

22940 K-1229
Oak Ridge Gaseous Diffusion Plant, Tenn.
AN ELECTROSTATIC PRECIPITATOR FOR THE COLLECTION OF URANIUM TETRAFLUORIDE DUST. R. C. Smith. Apr. 30, 1956. Decl. May 4, 1960. 16p. Contract W-7405-eng-26. OTS.

Two electrostatic precipitators were built for use in removal of UF_4 dust from a mixture of gases emerging from a reactor in which the UF_4 was formed by the reduction of UF_6. The second model was an improvement on the first and was designed to operate with an improved reactor. This model consisted of two coaxial cylindrical electrodes, the outer being about 6 ft long and 5 in. in inside diameter. The electrodes were insulated from each other and in operation there was a potential difference of approximately 9 kv between them. The outer cylinder was grounded, and the inner was negatively charged with respect to the outer. The dust-laden gas from the reactor flowed between the cylinders after passing through a region filled with corona discharge; this region was an annular space between a sharp-edged disk, affixed to the center electrode, and the outer cylinder. Dust particles in the gas acquire a negative charge when passing through the corona and are collected on the inner walls of the outer cylinder. The precipitator was mounted above and coaxially with the reactor. With this arrangement the dust collected on the precipitator walls was removed by a scraper operated without disassembly; the dust was removed from a product container flanged to the bottom of the reactor. Efficiency of the precipitator under operating conditions was approximately 95%. Temperature of the entering gas was about 450°F, pressure was approximately 2.5 psia, and flow was in the order of 1.5 std. cfm. The use of the precipitator in the present application permitted the reactor to be operated for considerably longer runs by prolonging the life of the filters in the gas exit line. (auth)

22941 MCW-1373
Mallinckrodt Chemical Works, St. Louis.
PROCESS DEVELOPMENT QUARTERLY REPORT. PART I. A. E. Ruehle and J. U. Shepardson. Apr. 1, 1955. Decl. June 10, 1960. 116p. Contract W-14-108-eng-8. OTS.

Data are presented on amenability studies on new feed-materials; vanadium solubility studies; extraction of europium, thorium, iron, boron, molybdenum and vanadium into tributyl phosphate-kerosene solutions; uranium trioxide studies; reactivity test for UO_3; scavenger additives to crucible charge; thermal conductivity of National CS-312 graphite; determination of hydrogen in uranium; and the application of the Chevenard thermobalance to the determination of moisture in slag liner and UF_4. (For preceding period see MCW-1372.) (W.L.H.)

22942 NP-9070
Eldorado Mining and Refining Ltd. Research and Development Div., [Ottawa].
RESEARCH AND DEVELOPMENT QUARTERLY REPORT, APRIL TO JUNE 1960. 13p. (R60-2).

In the solvent-in-pulp program, apparatus was assembled for continuous extraction, and preliminary tests were conducted using only clear solutions. The use of columns was investigated in sulfuric acid stripping of amine extracts. Stage efficiency appeared to be quite low and further work will be done using standard mixer-settler units. Addition of ferric sulfate to Beaverlodge pregnant solution was effective in removing vanadium but further work would be required to determine the feasibility of iron recovery for recycle. A summary of work conducted at the University of British Columbia on pressure reduction of aqueous solutions of uranium is given in the appendix. (auth)

22943 NYO-1313
Mallinckrodt Chemical Works, St. Louis.
PROGRESS REPORT OF PILOT PLANT WORK ON UF_4 PRODUCTION BY CONTINUOUS METHODS; PERIOD

APRIL 22, 1950 TO JULY 31, 1950. E. K. Teter. Nov. 2, 1950. Decl. Mar. 7, 1960. 8p. OTS.

Low-UF_4-assay feed material (about 95% UF_4) can be successfully rerun through the double-pass reactor. The discharged product is high in assay and does not excessively increase in metal pickup. A rerun may be operated at a maximum feed rate of 150.0 lb/hr without overloading the equipment. The method of shutting down a run in the double-pass reactor can seriously affect the nickel pickup of the following run. It is desirable to avoid excessive stirring after the feed has been turned off so that there is no metal-to-metal rubbing contact. Illium-R (rolled) has proved to be a very good material of construction for a reactor and conveyor in the UF_4 continuous equipment. No corrosion by HF-H_2O was observed. Nickel pickup from the Illium has been about equal during normal runs to that obtained from the inconel equipment. Continuously-made low temperature UO_2 (1100°F) was readily converted to UF_4 in the double-pass reactor providing the maximum operating temperature was no lower than 1100°F and the feed rate did not exceed 75.0 lb/hr. Nickel pickup with the low temperature UO_2 is about equal to that obtained with regular (1500°F) UO_2 production. (auth)

22944

IMPROVEMENTS IN OR RELATING TO TREATMENT OF ORES. Harry Julius Emeleus, John Keith Dawson, and Arthur Edward Truswell (to United Kingdom Atomic Energy Authority). British Patent 844,841. Aug. 17, 1960.

A method is presented for separating metals from ores by the formation of volatile fluorides from these metals; metals which may recovered in this way are U, Mo, and W. The method consists of mixing an ore (previously treated with HF for Si) with an oxide of As(III), Sb, or Bi in a quantity up to 40 to 50 wt.%, drying the mixture, placing into a Ni reaction vessel, introducing BrF_3 (or ClF_3) at a controlled flow, and trapping the evolved fluorides together with a little BrF_3 in a condenser. Afterwards, UF_6 may be evaporated from BrF_3 by raising the condenser temperature. The function of the As, Sb, or Bi oxide is to speed up the fluorination reaction. (D.L.C.)

Separation Processes

22945 CF-51-12-32

Oak Ridge National Lab., Tenn.

SOLVENT EXTRACTION: PULSE WAVE STUDIES AND PULSE GENERATOR DEVELOPMENT. Quarterly Report for Period August 10, 1951 to November 10, 1951. J. E. Conaway and A. C. Jealous. Dec. 6, 1951. Decl. Mar. 23, 1960. 17p. OTS.

Results of pulse generator studies indicate more efficient column operation by use of a sharp (semi-square) pulse wave instead of the harmonic type. Uranium loss values in simulated purex first-cycle pulse column tests employing such waves were reduced by a factor of 5. Uranium losses in Purex 1-A, 1-B, and 1-C columns are also reported. An air-driven bellows for generation of semi-square pulse waves was built and tested for application in the pilot plant plutonium second cycle pulse columns, the solvent recovery column, and for the corresponding columns in the metal recovery plant. Other types of generators designed to provide semi-square pulse waves are being developed. (J.R.D.)

22946 HW-41838

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR SAFETY CONSIDERATION FOR CONTINUOUS ION EXCHANGE COLUMN DESIGN. N. Ketzlach. Mar. 7, 1956. Decl. Apr. 27, 1960. 4p. Contract W-31-109-Eng-52. OTS.

The preliminary design is presented of a continuous ion-exchange system, for a given capacity, that meets nuclear-safety requirements. (W.L.H.)

22947 HW-44974

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ORGANIC CONTINUOUS CARTRIDGE FOR THE PUREX 2D COLUMN. G. M. Hesson. Aug. 16, 1956. Decl. June 10, 1960. 14p. Contract W-31-109-Eng-52. OTS.

A nozzle plate cartridge for the extraction section and a mixed plate cartridge containing both stainless steel and fluorothene sieve plates for the scrub section were developed. In 3- and 4-in.-diameter glass columns, these cartridges have a uranium-extraction efficiency as good as, or better than, the present cartridge; they have a scrubbing efficiency, based on the transfer of chloride ion, which is about the same as the present cartridge. (auth)

22948 IDO-14427

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PERFORMANCE OF THE TBP PROCESS FOR ALUMINUM FUELS; IDAHO CHEMICAL PROCESSING PLANT, 1955–1956. K. L. Rohde. Jan. 30, 1958. Decl. May 12, 1960. 53p. Contract AT(10-1)-205. OTS.

Observations of the performance of the Idaho Chemical Processing Plant as modified for continuous dissolution and TBP 1st cycle extraction, as to process chemistry and process engineering are reported for the initial plant-scale full-irradiation-level operating run. As-operated flowsheets, the results of plant scale tests of the continuous dissolver, and fission product decontamination data are emphasized. (auth)

22949 NAA-SR-Memo-1418

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

SOME COMMENTS ON THE U^{232} AND Th^{228} PROBLEMS IN RECYCLED Th–U FUELS. E. F. Weisner. June 27, 1955. Decl. June 10, 1960. 15p. OTS.

The problems associated with recycling Th–U fuel in SGR type reactors are reviewed. It is concluded that after a few cycles some means of remotely refabricating the fuel will be required. This results from the production of U^{232}, principally by an (n,2n) reaction on Th^{232}, and the inability to remove either the U^{232} or its first daughter, Th^{228}, by chemical means. Both the Th and the U acquire very high gamma activities a short time after processing so that sufficient time for direct refabrication probably does not exist. (auth)

22950 ORNL-479(Del.)

Oak Ridge National Lab., Tenn.

PUREX PROCESS FOR PLUTONIUM AND URANIUM RECOVERY. W. B. Lanham and T. C. Runion. Oct. 4, 1949. Decl. with deletions Apr. 18, 1960. 11p. Contract W-7405-eng-26. OTS.

Laboratory data which indicate that the recovery of Pu and U and decontamination from fission products are feasible in a solvent extraction process using tributyl phosphate are given. The procedure consists of extracting Pu(IV) and U with 15% TBP–85% Varsol using 5.0 $\underline{N}$ HNO_3 as a salting agent. (J.R.D.)

22951 ORNL-1854

Oak Ridge National Lab., Tenn.

DETERMINATION OF PLUTONIUM AND URANIUM IN SCRUP DISSOLVER SOLUTIONS. R. W. Foster and J. H.

Cooper. July 14, 1955. Decl. June 10, 1960. 28p. Contract W-7405-eng-26. OTS.

Methods for the determination of plutonium and uranium in highly radioactive scrup dissolver solutions have been developed. Plutonium was separated from the dissolver solutions by solvent-extraction and ion-exchange techniques and determined by potentiometric titration. Uranium was separated by ion exchange and determined by potentiometric titration. Solutions that were similar to the actual dissolver solutions and that contained known amounts of plutonium and uranium were analyzed by these methods. Evaluation of the data secured for the determination of plutonium and uranium by the methods given indicated that, within the limits of the precision of the methods, there was no bias. The precision of the data obtained for the determination of plutonium, expressed as the relative standard deviation, was better than 2% for plutonium in the concentration range of 0.27 to0.64 mg/ml. The precision for uranium was estimated to be about 0.2% for uranium concentrations of 425 mg/ml. These methods and the data obtained by them are discussed. The procedures are appended. (auth)

22952 ORNL-2909

Oak Ridge National Lab., Tenn.

PROCESSING OF HIGH-FIRED URANIUM DIOXIDE FUELS BY A REDUCTION–MERCURY EXTRACTION–OXIDATION PROCESS. A. F. Messing and O. C. Dean. Aug. 12, 1960. 13p. Contract W-7405-eng-26. OTS.

A preliminary flowsheet for the purification of uranium dioxide fuels by a magnesium reduction–mercury extraction–steam oxidation process is proposed. Feasibility was indicated by laboratory-scale scouting experiments. Data evaluation indicated 100% reduction of uranium dioxide by magnesium although this figure was not demonstrated, chiefly because of poor choice of materials and design of equipment. Steam oxidation of uranium tetramercuride produced an oxide with an O/U ratio of 2.43. This ratio was decreased to 2.09 by heating the oxide in a hydrogen atmosphere at 900°C for 1 hr. The final product had a surface area of 3.5 m^2/g, and 18% of the particles were $< 1\ \mu$ diam. A pellet of the oxide sintered at 1750°C had a density of 9.76 g/cc, 89% of theoretical. Decontamination factors demonstrated for ruthenium, cesium, and samarium, when present originally in amounts equivalent to 30,000 Mwd/ton fuel burnup and 60 days' decay, were $>$ 103, 220, and 75, respectively. (auth)

22953 TID-280

Technical Information Service, AEC.

MISCELLANEOUS. Reports from Session XIV, General Information Meeting, October 24, 25, 26, 1949, Oak Ridge, Tennessee. Decl. Mar. 28, 1960. 78p. OTS.

Papers are presented on the following subjects: investigation of Redox Systems with Infrared absorption; Ozonization of Redox Solutions for Ru Decontamination; Filtrol Scavenging for Decontamination of Redox Solutions; Design and Performance of Pulse Column Countercurrent Contactor; Metallic Complexes in HCl; Beta Assay of High Salt Content Liquid Waste Solutions; Thermoluminescence of X-ray and Pile Irradiated Alkali Halides between 80 and 500°K; Electrical Resistivity of Po; Behavior of Electrodes in a High Intensity Radiation Field; and Development of a Precision, Steady-state Resistance-bridge Calorimeter. (W.L.H.)

22954 CEA-tr-R-817

DE L'INFLUENCE DES NITRATES DE BARYUM, DE NICKEL, DE COBALT ET DE CUIVRE SUR L'EXTRACTION DE L'ACIDE NITRIQUE AU TRIBUTYLPHOSPHATE (TBP). (Effects of Nitrates of Barium, Nickel, Cobalt, and Copper on the Extraction of Nitric Acid in Tributylphosphate). A. S. Solovkin (Solovrin), N. S. Povitskiĭ, and I. V. Shilin (J. V. Chilin). Translated into French from Zhur. Neorg. Khim. 4, 1454-6(1959). 10p.

The distribution of HNO_3 between the aqueous phase and TBP-kerosene was studied in the presence of nitrates of Ba, Ni, Co, and Cu when the ionic force of the aqueous phase is between 1 and 1.5. The extraction of HNO_3 increased when the ionic force increased. The lower distribution coefficients were obtained when $Ba(NO_3)_2$ was used. Nitrates of Co, Ni, and Cu are the only salts useful for HNO_3 in TBP. The extraction of HNO_3 in the presence of salts in TBP-kerosene mixture does not obey the ideal distribution laws. (tr-auth)

22955 CEA-tr-X-187

MÉTHODE DE SÉPARATION DU RUTHÉNIUM SANS ENTRAINEUR PAR L'OXYDATION AU PÉROXYDE DE PLOMB. (Method of Separation of Carrier-free Ruthenium by Oxidation with Lead Peroxide). T. Kambara. Translated into French from Bunseki Kagaku 7, 439-40(1958). 18p.

Experimental research on separating ruthenium without carrier from a fission product mixture by oxidation distillation is described. The ruthenium is separated from sulfuric media by oxidative distillation with lead peroxide. A hard glass apparatus with ground fittings was used. During distillation air was fed in as a vehicle by a small valve. Results of the study of the relation between reagent concentration in the mixture and yield show that operation with a total volume of 40 to 50 cm^3 and 44% H_2SO_4 and adding 2.0 g of lead peroxide gives the best yield. This reaches an average of 97%. Upon investigation of the radioactive contamination from Ce^{114} a decontamination factor of 2×10^4 was found. A distillation time of 15 min was sufficient. This method has the advantage over other methods of a high yield. (tr-auth)

22956

SOME EXPERIMENTS WITH IMPORTANT FISSION PRODUCTS. G. Rudstam (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala). Atompraxis 6, 124-8(1960) Apr.-May. (In English)

The behavior of some important fission products (strontium, yttrium, zirconium, niobium, ruthenium, tellurium, cesium, barium, lanthanum, cerium, praseodymium, and neodymium) in certain separation procedures was investigated. These included extraction with diethyl ether, dibutyl carbitol, and tributyl phosphate; coprecipitation with ferric hydroxide; adsorption on anion exchange resins on the hydroxide form; and adsorption on cation exchange resins. (auth)

22957

SEPARATION OF IRON FROM RARE-EARTH ELEMENTS. J. H. Krepelka, K. Vetejska, and J. Mazacek. Collection Czechoslov. Chem. Communs. 24, 198-202(1959). (Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86043).

The possibility was ascertained of a separation of Fe from rare-earth elements (REE) by means of strongly basic anionite OAL (anionite particle size 0.52 to 0.25 mm, column 1 cm in diameter, and holding capacity 20 to 25 ml). In model-study experiments on sorption of $FeCl_3$ and chlorides of REE, depending on the concentration of HCl, the anionite-containing column was washed with a solution of HCl (100 ml) of the same concentration as that of the solutions being analyzed; the latter were prepared by dissolving 30 mg of oxides of REE (obtained by fractionation of monazite concentrate) and 40 mg Fe_2O_3 in 50 ml HCl of different concentration. The analyzed solutions were passed through the anionite column at a rate of 0.5 ml/minute, and filtrate fractions of 5 ml were taken for analysis. Presence of REE was determined by precipitation with 2% solution NH_4OH and staining of precipitates with Alizarin S; for quantitative estimation the precipitates were calcined and weighed. Fe was determined photometrically with KSCN. It was found that in the interval of HCl concentration 0.1 to 9 N, no sorption of Ce, La, Pr, Nd, Sm, and Y took place. Ratio of the elution constants shows that separation of Fe from REE by means of anionite OAL can be effected in a medium of approximately 8 N HCl. Under these conditions Fe is quantitatively retained by the anionite, while REE pass in the filtrate. The anion-exchange method is applicable for determination of Fe in monazite concentrate. In such a case Zr as well as Fe undergoes sorption on anionite, but it does not interfere with determination of Fe; Th passes in the filtrate together with REE. On analysis of a number of synthetic samples and of natural minerals, good results were obtained.

22958

SEPARATION OF NIOBIUM AND TANTALUM BY ADSORPTION-COMPLEXING CHROMATOGRAPHY. L. S. Aleksandrova and K. V. Chmutov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 5, 801-5(1960) May. (In Russian)

Nb^{95} and Ta^{182} tracers were used to follow the separation of niobium and tantalum on a 10 g activated charcoal column saturated with phenyarsonium acid. The length of the column was 250 mm with an internal diameter of 10 mm. A 4 % ammonium oxalate and 0.65 N HCl solution containing 12.5 mg each of niobium and tantalum in 100 ml was passed through the column heated to 95° C at a rate of 40 ml/hr. Tantalum is completely retained by the column, while the bulk of the niobium passes into the eluate. An additional 100 to 150 ml of 4 % ammonium oxalate—0.65 N HCl solution is required to elute all the niobium. It is difficult to remove tantalum completely from the column. The best results in removing tantalum were obtained with a 7 % oxalic acid solution which removed 60 % of the tantalum in 350 ml. Further development of this method with the use of new precipitants on activated charcoal is considered promising. (TTT)

22959

CHROMATOGRAPHIC SEPARATION OF ZIRCONIUM AND HAFNIUM OXYCHLORIDES ON SILICA GEL. V. Yatirajam and J. Gupta (National Chemical Lab., Poona, India). J. Sci. Ind. Research (India) 19B, 270-1(1960) July.

A natural mixture of hydrated zirconium and hafnium oxychlorides, obtained by alkali fusion of Indian zircon followed by crystallization from hydrochloric acid, was used directly in an acidic methanolic solution for frontal separation of the two oxychlorides over activated silica gel. Three fractions were collected: (i) Hf/Zr wt. ratio ≤0.01%, (ii) Hf/Zr c. 0.5%, and (iii) Hf/Zr >20%, with average yields of 70 to 75, 25 to 20, and 5%, respecively, of input in terms of oxide equivalents. (auth)

22960

THE EFFECT OF A DILUENT ON THE EXTRACTION OF URANYL NITRATE WITH TRIBUTYLPHOSPHATE. M. Siekierska. Roczniki Chem. 32, 1369-73(1958). (Translated from Referat. Zhur. Khim. No. 20, 1959, abstract No. 70695).

The dependence of $UO_2(NO_3)_2$ extraction by solutions of tributyl phosphate in kerosene, C_6H_6, CCl_4, cyclohexane, $C_5H_{11}OH$ and isoamylacetates on the TBP concentration in the organic phase was investigated. The aqueous phase contained 0.0262 of $UO_2(NO_3)_2$, 4.01 of NH_4NO_3, and 4.20 mol/kg of HNO_3. The $UO_2(NO_3)_2$ concentration in the organic phase gradually increased as the tributyl phosphate concentration increased and reached its maximum value (for all diluents, except $C_5H_{11}OH$) when the tributyl phosphate concentration was equal to or less than 50%. The degree of $UO_2(NO_3)_2$ extraction from aqueous solutions of similar concentration, acidified with HNO_3 (0.05 mol/kg), increased almost linearly with tributyl phosphate concentration (up to 60 to 80%). The nature of the diluents had little effect on the extraction, with the exception of $C_5H_{11}OH$, which decreased the extraction capability considerably.

22961

DESORPTION OF MICRO-QUANTITIES OF STRONTIUM AND CAESIUM FROM MONTMORILLONITE AND KAOLINITE. V. V. Gromov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim. 34, 1357-63(1960) June. (In Russian)

The desorption of Sr^{90} and Cs^{137} from montmorillonite and kaolinite by $CaCl_2$ and NaCl solutions was investigated. A formula which described the desorption of micro-amounts of ions and which corresponded to the ion exchange and completely reversible sorption processes of the ions was proposed. It was shown that sorption of strontium-90 by montmorillonite and kaolinite is completely reversible, whereas, that of cesium-137 is partially irreversible. (auth)

22962

SEPARATION OF PLUTONIUM. (to United Kingdom Atomic Energy Authority). British Patent 844,151. Aug. 10, 1960.

A method is described for the separation of Pu in the reduced state from neutron-irradiated uranium in aqueous solutions which have been previously processed, e.g., by the bismuth phosphate extraction process. A slurry of potassium lanthanum sulfate is added to the Pu solution (previously made acid with HNO_3 and ≥1 M F^-), and the slurry falls through the solution carrying Pu with it. This carrier precipitation method has improved characteristics, e.g., crystalline structure and faster settling rate, over other carrier processes such as LaF_3. Several applications of this method are given together with the conditions for the preparation of the slurry and the behavior of La^{3+}, K^+, and SO_4^{2-} in different solution media. This method can also be applied to solutions of Pu in the oxidized state; the only difference is that the fission products are carried down by the slurry rather than Pu, which remains in solution. (D.L.C.)

22963

IMPROVEMENTS IN METHODS OF SEPARATING URANIUM AND THORIUM FROM EACH OTHER. Rene Mahut, Joseph Muller, and Jean Sauteron (to Commissariat à l'Énergie Atomique). British Patent 844,283. Aug. 10, 1960.

A method was given for the separation of uranium and thorium in raw materials which was both inexpensive and rapid. The method consisted of dissolving the uranium- and thorium-containing material by a slight mineral acid excess, adding Na_2SO_4 to the acid solution in a molar quantity equal to the sum of the uranium and thorium and Th gram-atoms, raising the solution temperature to between 25 and 60°C, and neutralizing it to pH 3 to 4. Thorium was precipitated in the form of a basic sulfate while uranium remains in solution. In one experiment, uranothorianite was dissolved by HNO_3 at 80°C and treated in the above manner; 98.5% of the original thorium was precipitated. In another experiment, an ore with a thorium/uranium ratio of 10 was treated; the thorium sulfate precipitate consisted of 99.95% thorium and 0.05% uranium; whereas, the solution retained 1% of the total thorium. (D.L.C.)

22964
IMPROVEMENTS IN OR RELATING TO METHOD OF SEPARATING STRONTIUM FROM OTHER FISSION PRODUCTS. Eugen Glueckauf (to United Kingdom Atomic Energy Authority). British Patent 844,376. Aug. 10, 1960.

A method for the separation of Sr from fission products in aqueous solutions by HNO_3 precipitation is given which also effects the separation of Sr from Al, a common component in radioactive waste solutions from reactors. Although Al precipitates as well as Sr upon the acidification of the solution to 19 $\underline{M}$ HNO_3 at 25°C, the solubility of $Al(NO_3)_3$ increases much more rapidly with temperature than that of $Sr(NO_3)_2$, and the method separates Sr from Al and fission products by carrying out the HNO_3 precipitation at 50 to 75°C (depending on the Al concentration) for >12 hours. In an experiment, a precipitate was obtained containing 97% of the original Sr and no Al or other fission products except a small amount of Ba; the latter, however, does not interfere in the radioassay for Sr. (D.L.C.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

22965 AFOSR-TN-60-225
Princeton Univ., N. J. Forrestal Research Center.
AN ANALYSIS OF THE EFFECTS OF PERFECT GAS PARAMETERS ON GAS TURBINE PERFORMANCE. Report 500. Andrew G. Hammitt. Dec. 1959. 31p. Project No. 9781. Contract AF49(638)-465.

It was found that the parameters (specific-heat ratio (γ), speed of sound (a), and viscosity (μ)) are sufficient to define a perfect gas for use in a single gas turbine cycle with regenerator. Low γ and high a were found to be advantageous to operation of the heat exchangers, whereas high γ and low a were beneficial to the turbo machinery. Best values of γ and a were found to depend on the relative cost of different types of equipment. (C.J.G.)

22966 KAPL-2000-10(p.B.1-B.10)
Knolls Atomic Power Lab., Schenectady, N. Y.
VIBRATION OF CONDENSER TUBES. D. R. Miller.

Measurements of tube vibration which were made on a main condenser of a nuclear power plant confirmed the adequacy of an improved design of steam-dump baffles. The principal results of the measurement program are presented, together with a description of the instrumentation and a discussion of the condenser tube vibration problem. (W.D.M.)

22967 KAPL-2000-10(p.B.32-B.41)
Knolls Atomic Power Lab., Schenectady, N. Y.
ANALYSIS OF THE EFFECTS OF CHECK VALVE SLAMMING ON THE STEAM GENERATOR PASS PARTITION PLATE USING A LUMPED PARAMETER MODEL. T. D. Younkins.

Associated with each main coolant pump in a PWR is a check valve to prevent excessive backflow through the leg when the pump is idle. The effect of the pressure surge from check valve slamming on the U-tube steam generator pass partition plate is analyzed by using a lumped parameter model. (W.D.M.)

22968 KAPL-2000-10(p.D.13-D.25)
Knolls Atomic Power Lab., Schenectady, N. Y.
MAIN COOLANT CHECK VALVE TEST LOOP (TF-17). E. W. Kunz and W. P. Ott.

The TF-17 facility was construoted to enable experimental study of the performance characteristics of various types of check valves under simulated service conditions. The objective of the combined experimental and theoretical program is to evaluate and optimize the performance of various types of check valves and to develop methods of theoretical analysis of the performance of check valves in nuclear systems. TF-17 is designed to simulate pump startup and shutoff transients. The details of loop arrangement and construction are shown. (W.D.M.)

22969 KAPL-M-LD-5
Knolls Atomic Power Lab., Schenectady, N. Y.
BENDING STRESSES IN A PRESSURE VESSEL WITH AN INTEGRAL FLAT HEAD. L. Deagle. [1960]. 19p. Contract W-31-109-eng-52. OTS.

Formulas were derived for maximum bending stresses in the head and cylindrical shell of a pressure vessel with an integral flat head using the thin-wall theory. Curves were plotted in nondimensional form to facilitate computations, and a sample problem was solved. (M.C.G.)

22970 NAA-SR-5241
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
A COMBINATION STRAINER AND BLOCKING VALVE FOR LIQUID METAL SYSTEMS. F. S. Nayor and J. S. McDonald. Aug. 30, 1960. 20p. Contract AT-11-1-GEN-8. OTS.

A 3-in. pipe-size combination valve and strainer device performed satisfactorily when tested in a sodium system. The device provided a means of removing an in-line strainer element from the system without draining the sodium and alternately served as a plug type blocking valve. Tests were conducted over a temperature range of 500 to 950°F and system pressures of 0, 5, and 10 psi at NaO contents of 50 to 400 ppm. The strainer element was isolated from the system by freezing the sodium around the valve plug. The time required to freeze the sodium was found to be primarily a function of system temperature, a typical value being 75 min for a system temperature of 800°F. (auth)

22971 NAA-SR-Memo-4906
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
CENTRIFUGAL PUMP CHARACTERISTICS IN THE NEAR-BOILING RANGE. S. Sudar and A. Gallegos. Jan. 26, 1960. 18p. OTS.

Tests were made for SGR hazard studies on the performance of a centrifugal pump when the circulating fluid was in the boiling or near-boiling range. Hot water was used as the test fluid in pumps having different impeller designs and different specific speed values. The pump discharge rate was determined as a function of fluid temperature and suction pressure. The possibility of complete flow stoppage when fluid boiling occurred in the suction side of the pump was investigated. A test run consisted of circulating water in the test loop at constant temperature and constant level within the supply tank. The static suction conditions were gradually changed by lowering the liquid level in the supply tank in fixed increments until flow stoppage occurred. This procedure was repeated for water at various temperatures from 180°F to the boiling point at that elevation, 210°F. (M.C.G.)

22972 PWAC-300
Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.
DEVELOPMENT OF AIR TURBINE DRIVE COMPONENTS FOR THE PRATT AND WHITNEY AIRCRAFT LIQUID METAL TURBOPUMP, TP-1. J. S. Murphy, R. S. Lombard, R. G. Haskell, and J. D. Sutherland. June 30, 1960. 64p. Contract AF33(600)-41233.

The components testing program for development of the TP-1 air-turbine drive consisted of (a) full-scale fiberglass model tests of the TP-1 turbine inlet scroll using subsonic air, (b) subsonic air tests of five tangential inlet type fiberglass turbine inlet-scroll models, (c) cold hydrostatic tests of the prototype TP-1 turbine scroll using a stresscoat technique, (d) evaluation tests of three types of carbon-face seals, and (e) a single endurance test of the most promising carbon-face seal. As a result of these component development tests, satisfactory modifications to the prototype turbine inlet scroll were effected, the operating stress levels in the scroll at design conditions were determined to be noncritical, and the performance of the best carbon-face seal tested was found to be acceptable from a leakage standpoint. A successful endurance test of approximately 1400 hr was conducted on this seal with an average leakage of about 0.5 cc/hr. (auth)

22973
OBSERVATION OF BRICKWORK OF PHOSPHORUS OVENS USING RADIOACTIVE PREPARATIONS. K. Schmeiser (Knapsack-Griesheim A. G., Cologne). Atompraxis 6, 133-8(1960) Apr.-May. (In German)

The supervision of furnace-wall thicknesses during operation by means of radioactive isotopes has definite advantages. A close examination of furnace walls and floor is ordinarily possible only when the furnace is completely empty. But since this requires several weeks, during which the furnace cannot be used, it is practicable only when extensive repairs are necessary. However, this is usually not the best time to replace wornout sections. On the other hand, radioactive substances can be installed to indicate when the furnace lining must be replaced (either completely or partially) without having to put the furnace out of operation. After a radioactive substance is applied to the wall, it is necessary to decide where the substance shall remain. Co^{60} was found both in ferrophosphorus (3.4 nC/kg) and in phosphorus slag (0.75 nC/kg). The specific activities which were found preclude any danger from radiation. A slight amount of activity was left in the furnace. Whenever the furnace is emptied, this activity can be measured to obtain information on currents. (auth)

22974
SAFE DESIGN OF IN-PILE TESTS. Theodore Beresovski (U. S. Atomic Energy Commission [Liaison Office], Brussels). Nucleonics 18, No. 9, 106; 108; 111-12; 114-16; 118 (1960) Sept.

Each in-pile irradiation experiment must be designed to insure safety under normal operating conditions and all "credible" abnormal circumstances involving the reactor as well as the test apparatus. Specifically, four major hazards must be examined, their probabilities assessed, and their potential consequences determined. These are excessive temperature, material and component failure, sudden reactivity change, and chemical explosion. These hazardous conditions are eliminated as far as possible without compromising the desired experimental conditions, and multiple safety provisions that operate simultaneously to insure against major accidents are used. (M.C.G.)

22975
STUDIES ON REPAIR WELDING AGE-HARDENABLE NICKEL-BASE ALLOYS. W. J. Lepkowski, R. E. Monroe, and P. J. Rieppel (Battelle Memorial Inst., Columbus, Ohio). Welding J. (N. Y.) 39, 392-s-400-s(1960) Sept.

Repair welding of two age-hardenable nickel-base alloys, René 41 and Astroloy, was studied. Repair welds were made on restrained, aged material by several techniques. Samples were then subjected to thermal cycles simulating jet-engine operation. The experimental studies showed that René 41 alloys could be repair welded and subjected to temperatures in the aging range (around 1400°F) without failure if the repair welds were given a localized solution treatment at 1950°F or were hammer peened at room temperature. One specimen of Astroloy was repair welded and reaged at 1650°F without failure. It was necessary to develop techniques for preventing cracking in the base metal of Astroloy during the solution and aging heat treatments that followed the original welding operation. Hastelloy "W" and René 41 filler metals produced less stop-start cracks during the preparation of René 41 restrained-type weld specimens than did Hastelloy "X." Hastelloy "X" was the only filler metal used in Astroloy; therefore, no evaluation of fillers used with this alloy was possible. (auth)

22976
A NEW HIGH-TEMPERATURE MANGANESE-BASE BRAZING ALLOY. Raymond C. Kopituk (Thiokol Chemical Corp., Denville, N. J.). Welding J. (N. Y.) 39, 401-s-5-s (1960) Sept.

A new manganese-base brazing alloy, combining many of the advantages of both silver and nickel high-temperature brazing alloys, was examined for rocket engine applications. This alloy contained approximately 16 % nickel, 16 % cobalt, less than 1 % boron, and the balance manganese. It was developed to provide inherent ductility in the brazing alloy and to reduce the alloying effect characteristic of nickel-base alloys. Good flow characteristics were obtained between 1850 and 1950°F. The alloy promoted little or no grain growth. In bending tests, there was deformation but no evidence of cracking. The tensile properties of the alloy were similar to Type 347 stainless steel at room temperature. To the limits of the tests performed, Mn-Ni-Co-B alloy did not age harden either when furnace brazed or when braze welded. The samples underwent no change in microstructure when subjected to 300, 400, 600, and 800°F for 1 hr. (M.C.G.)

22977
BRAZING AND SOLDERING OF BERYLLIUM. R. W. Keil, G. S. Hanks, and J. M. Taub (Los Alamos Scientific Lab., N. Mex.). Welding J. (N. Y.) 39, 406-s-10-s(1960) Sept.

The brazing of Be to itself by furnace-brazing, induction-brazing, and soft-soldering techniques was investigated. Undercoatings for subsequent tinning, soldering, and brazing were applied by flame spraying, electrodeposition, torch coating, and molten-metal dipping. Since Be possesses strong reactivity with O, particularly at elevated temperatures, it was necessary to carry out the brazing operations in a vacuum or inert atmosphere. Fluxes were not used in the actual joining operation because of possible corrosion problems presented by their use. Good surface coatings were obtained by electroplating Be with Cu or Ag from cyanide or acid solutions. Furnace brazing in an electric muffle furnace was most successful when pure Ag, BAg-1, or Ag—30 wt.% aluminum was used with samples mechanically cleaned or chemically etched. Excellent joints were obtained using Mg to precoat the Be. Precoating with the Mg and subsequent brazing was best accomplished by induction heating. Soft soldering was found to be an effective method of joining Be when the design of the joint permitted the use of a press fit. (auth)

22978

WELDING OF TRITON, WORLD'S LARGEST NUCLEAR-POWERED SUBMARINE. G. W. Kirkley, Jr. (General Dynamics Corp., Groton, Conn.). Welding J. (N. Y.) 39, 893-902(1960) Sept.

The Triton's hull is of 100% welded construction with the exceptions of the deck hatches and torpedo tube doors. They are the only mechanical connections. Manual shielded metal-arc and automatic submerged-arc processes were used in the fusion welding of the hull. The reactor and steam piping were welded by using a combination of the inert-gas shielded tungsten-arc and the metal-arc processes. Copper tubing was silver brazed. The heavy lead shielding was cast and welded by lead burning. All materials were inspected thoroughly both before and after welding. A consumable-insert method of welding was developed to eliminate the crevice between the backing ring and pipe caused by conventional methods. Bimetallic welds were used in the heat exchanger system. A description of the Triton is included. (M.C.G.)

22979

THE DEVELOPMENT OF COMPRESSORS AND DRIVES FOR GAS-COOLED REACTORS. L. J. Goudy and R. D. Teire (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). p.254-76 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

The particular requirements of compressors applied to reactor cooling were discussed. Some of these special requirements that had not previously been met and the possible types of compressor, together with the various methods of driving them, were reviewed. A typical solution, was given for the present British nuclear power stations. (auth)

22980

A GAS TURBINE FOR A HELIUM-COOLED REACTOR. Paul A. Berman (Westinghouse Electric Corp., Philadelphia). p.293-305 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

The rotating machinery and its associated seal system, which are being designed for the Maritime Gas-Cooled Reactor Project, were described. This closed-cycle, gas turbine will operate in a direct cycle with the reactor. The helium-working fluid will pass from the reactor directly into the turbines. The plant is to operate on a regenerative, inter-cooled cycle and is designed to produce 22,600 hp at the turbine coupling. (auth)

22981

POWER CONVERSION EQUIPMENT FOR THE ML-1 NUCLEAR POWER PLANT. C. M. Rice and R. K. Swain (Aerojet-General Nucleonics, San Ramon, Calif.). p.306-12 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

Power conversion equipment for the ML-1, a mobile, closed-cycle nuclear power plant, was described. It was stated that the equipment must possess the characteristics of high efficiency, low weight, small size, and high reliability. Included were descriptions of the major components of the power conversion system, their operating requirements, design specifications, and unique features. (auth)

22982

PROGRESS REPORT ON THE DEVELOPMENT OF GAS BEARINGS FOR TWO CLOSED-CYCLE GAS TURBINE ROTORS. Martin W. Eusepi and Dudley D. Fuller (Franklin Inst., Philadelphia). p.326-49 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

Progress in the gas bearing development for two closed-cycle gas-turbine rotors was reported. Design and experimental data were given showing the advantages and disadvantages of this type of bearing application. Several types of bearings for the early rotor were investigated with the final choice being a seven-pad self-compensating Kingsbury type thrust bearing with tilting-pad type crowned shoes and two tilting-pad type journal bearings each with three pads. The two lower pads on each journal bearing were externally pressurized units, the upper pad being self-acting. Rotational speeds as high as 20,000 rpm were obtained. Final development of the thrust bearing was halted due to the termination of the project. The journal bearings and the thrust bearing for the present rotor are externally-pressurized without tilting pads. However, each bearing surface is divided into three equal segments by appropriate grooving. Full loads were successfully carried by the bearings during non-rotational tests. Full speed, full load tests have not been completed. (auth)

22983

THE STORAGE AND HANDLING OF CRYOGENIC LIQUIDS. G. H. Zenner (Linde Co., Tonawanda, N. Y.). p.1-40 of "Progress in Cryogenics. Volume 2." K. Mendelssohn, ed. New York, Academic Press Inc., 1960.

A discussion is given of the equipment used for liquid oxygen. The equipment is used almost without change for liquid nitrogen or liquid argon as required. The special variations used for other cryogenic liquids are discussed. The physical properties of cryogenic fluids are tabulated; these fluids are oxygen, nitrogen, argon, methane, fluorine, hydrogen, and helium. The basic reason for most cryogenic developments is the same as that which led to the development of liquid oxygen, i.e., the advantage of storing and shipping an otherwise gaseous material in its concentrated liquid state. (B.O.G.)

22984

ADVANCES IN CRYOGENIC ENGINEERING. VOLUME 4. PROCEEDINGS OF THE 1958 CRYOGENIC ENGINEERING CONFERENCE, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASSACHUSETTS, SEPTEMBER 3-5, 1958. K. D. Timmerhaus, ed. A Cryogenic Engineering Conference Publication. New York, Plenum Press, Inc., 1960. 509p. $13.50.

The papers presented concern problems of using low temperature liquids (fluorine and hydrogen) as rocket propellants; the solubilities and compatibilities of other cryogenic systems; and the mechanical properties of several materials (steel, aluminum, plastics) at low temperatures. The testing, performance, and applications of various types of equipment and materials were also considered. The cryogenic processes are concerned primarily with liquid hydrogen or oxygen. The 44 papers presented here include three papers which were not presented at the proceedings. Two papers were abstracted separately. (B.O.G.)

22985

PUMPING OF LIQUID HYDROGEN. G. Caine, L. Schafer, and D. Burgeson (Borg-Warner Corp., Bedford, Ohio).

p.241-54 of "Advances in Cryogenic Engineering. Volume 4."

Tests were conducted on various types of pumps for cryogenic fluids. The pumps described were centrifugal models designed for liquid hydrogen. The tests were conducted to obtain specific data on hydraulic performance and mechanical feasibility of the particular units. The model size pumps shown are not to be considered as the optimum configuration for their reduced capacity, but as reduced size models in order to get cavitation and other performance data for full size units. (B.O.G.)

22986

ADVANCES IN CRYOGENIC ENGINEERING. VOLUME 5. PROCEEDINGS OF THE 1959 CRYOGENIC ENGINEERING CONFERENCE, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA, SEPTEMBER 2-4, 1959. K. D. Timmerhaus, ed. A Cryogenic Engineering Conference Publication. New York, Plenum Press, Inc., 1960. 584p. $13.50.

The papers presented cover applications and techniques for storage and handling of cryogenic materials; the technological aspects of cryogenic liquids as rocket propellants; development of low-temperature insulating systems; heat transfer; design and applications of metering devices, pumps, plastic insulation, and environmental control equipment; liquefaction and refrigeration cycles and systems; mechanical properties of aluminum and magnesium alloys, and steels at temperatures to −424°F; the fluid phenomena of liquid helium and hydrogen; and processes and data dealing with cryogenic materials. Sixty-eight papers are included; separate abstracts were prepared for six. (B.O.G.)

22987

LARGE-SCALE PRODUCTION, HANDLING, AND STORAGE OF LIQUID HYDROGEN. P. C. Vander Arend (Air Products, Inc., Allentown, Penna.). p.49-54 of "Advances in Cryogenic Engineering. Volume 5."

A description is given of a facility for the large-scale production, handling, and storage of liquid hydrogen. Crude oil, steam, and oxygen of 99.5% purity are reacted in the Texaco generator and a synthesis gas, primarily H_2, CO, or CO_2, is formed at 400 psig. The gas is cleaned and leaves the final scrubber with approximately 1% total impurities. The 99% pure hydrogen is liquefied then stored in 28,000-gal tanks. (B.O.G.)

22988

PRACTICAL STORAGE AND DISTRIBUTION OF LIQUID HYDROGEN AND HELIUM. W. E. Perkins and R. J. Frainier (Linde Co., Tonawanda, N. Y.). p.69-74 of "Advances in Cryogenic Engineering. Volume 5."

A description is given of some vessels used in the storage of liquid helium and hydrogen. A method is provided for estimating insulation requirements for other typical tankage. The fundamental differences between the bulk storage or shipment of liquid hydrogen and helium are pointed out. (B.O.G.)

22989

HANDLING LIQUID HYDROGEN ON A PILOT-PLANT SCALE. H. L. Laquer (Los Alamos Scientific Lab., New Mex.). p.85-94 of "Advances in Cryogenic Engineering. Volume 5."

The discussion summarizes experience gained while handling 5500-liter batches of liquid hydrogen. The work was not an objective in itself but was done coincidentally while developing and operating a liquid-hydrogen-cooled electromagnet. The quantities handled are small by missile standards, but the problems encountered are much nearer to those of large-scale usage than those of normal laboratory usage. The specific problems in the discussion are transportation, transfer, instrumentation, and safety. (B.O.G.)

22990

TRANSFER OF LIQUID HYDROGEN THROUGH UNINSULATED LINES. R. J. Richards, W. G. Steward, and R. B. Jacobs (CEL National Bureau of Standards, Boulder, Colo.). p.103-10 of "Advances in Cryogenic Engineering. Volume 5."

An investigation was conducted to determine the heat leak and pressure drop characteristics for uninsulated liquid-hydrogen transfer lines. The results are incorporated into single-phase flow design curves so that design variables may be selected to give optimum performance. Some applications in which this type transfer line may be practical or convenient are continuous high flow rates, temporary or experimental installations, and very brief and infrequent usage. In all of these cases, the system design requires knowledge of heat flux (heat transfer per unit time per unit area of exposed surface) and of the factors which influence the heat flux. (B.O.G.)

22991

IMPROVEMENTS IN OR RELATING TO SHIELDED CONTAINERS FOR RADIOACTIVE MATERIAL. (to Richard Frederick Fraser-Smith). British Patent 844,346. Aug. 10, 1960.

A shielded container for the carriage and storage of radioactive materials was constructed in such a way that the carried material is adequately shielded and yet can be immediately exposed by a simple pivoting movement. The container comprises two semispherical, pivotable parts, one positioned above the other with convex-concave mating surfaces, the top convex part having a hole for holding capsuled radioactive material. In the closed condition the capsule is adjacent to the mating surface, but the curvature of the surface ensures that no radiation escapes; in the open condition, the capsule is exposed in one direction only. The capsule-carrying stem is designed for easy loading and unloading of the container behind a shield. (D.L.C.)

Heat Transfer and Fluid Flow

22992 ARGMA-TN-1H1N-11

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

ONE-DIMENSIONAL COMPRESSIBLE FLOW TABLES FOR A PERFECT GAS IN MACH NUMBER INCREMENTS OF 0.001 (k = 1.20) STAGNATION TEMPERATURE CHANGE WITHOUT FRICTION. Cover carries title: COMPRESSIBLE FLOW TABLES k = 1.20 STAGNATION TEMPERATURE CHANGE WITHOUT FRICTION. C. Hoebich. July 1960. 90p.

Functions of Mach numbers for compressible perfect gas are tabulated. The ratio of specific heats is 1.20. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation. These tables are for stagnation temperature change without friction. (auth)

22993 CF-60-8-51

Oak Ridge National Lab., Tenn.

TEMPERATURE DISTRIBUTION IN A HOLLOW FUEL PELLET AND IN THE SURROUNDING METAL WALL. Dale R. Carver. Aug. 16, 1960. 14p. OTS.

The steady-state temperature distribution in a hollow cylindrical fuel pellet and in the surrounding metal wall, due to a heat source which varies linearly from one side of the element to its opposite side, in a coolant stream the temperature of which varies in the same fashion, is determined analytically. (auth)

22994 KAPL-2000-10(p.A.1-A.7)
Knolls Atomic Power Lab., Schenectady, N. Y.
DISCUSSION OF PLATE COLLAPSE TESTS. R. J. Simon.

If a fluid flows through an assembly of thin, flat plates, the plates deform as a result of the static pressure differences generated between adjacent flow channels. Various tests to compare the theoretical behavior of the ideal plate assembly with the behavior of real plate assemblies are discussed. (W.D.M.)

22995 KAPL-2000-10(p.C.7-C.16)
Knolls Atomic Power Lab., Schenectady, N. Y.
CORRELATION OF FRICTION COEFFICIENT WITH SURFACE ROUGHNESS GEOMETRY. J. P. Fraser.

Surfaces may be roughened to increase the average heat transfer coefficient and, under certain circumstances, to increase the critical heat flux for water-cooled heat transfer surfaces. A method is presented for calculating an effective roughness height to the hydraulic diameter ratio for ordered roughness patterns. Friction coefficients from three sources were correlated by the effective roughness height ratio. (W.D.M.)

22996 NAA-SR-Memo-4743
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
EFFECT OF FINS AND HEATER WIRES ON HEAT TRANSFER PROPERTIES IN CAPSULE DESIGN. R. O. Pearson. Dec. 11, 1959. 10p. OTS.

The effects of fins and heater wires on heat transfer properties in capsule design were studied. The temperature drop through two concentric tubes was measured under the following conditions: fins machined on the outside surface of the inner tube and in contact with the inside surface of the outer tubes; heat sources at the center of the inside tube; and steady-state heat generation. The temperature drop across the fins was 440°F compared to 132°F without the fins. The temperature drop through an annulus formed by two concentric tubes with heater wires wrapped on the outside surface of the inside tube was determined under these conditions: no heat generation in the heater wire; annulus filled with NaK; heat source at the center of the inside tube; and steady-state heat generation. The temperature drop across the NaK annulus with heater wires was 257°F compared to 207°F without them. (M.C.G.)

22997 OOR-407.55
Maryland. Univ., College Park.
ON CONDUCTING FLOW PAST A MAGNETIZED CIRCULAR CYLINDER. Interim Technical Report No. 46 [on] FUNDAMENTAL RESEARCH IN APPLIED MATHEMATICS. Lan-Keh Chi. June 1960. 46p. DA Project No. 5B99-01-004. Contract DA-36-034-ORD-1486.

The flow of a conducting fluid past a magnetized, infinitely long circular cylinder is investigated. A steady incompressible and inviscid fluid is considered. The drag forces on the cylinder due to both the fluid pressure and the Maxwell stresses are computed. (auth)

22998 OOR-2000.2
Northwestern Univ., Evanston, Ill.
EFFECT OF NATURAL CONVECTION ON TURBULENT HEAT TRANSFER IN THE CRITICAL REGION. Interim Technical Report No. 2 [for] July 1, 1959–December 31, 1959. Yih-Yun Hsu and J. M. Smith. 30p. DA Project No. 5B99-01-004. Contract DA-11-022-ORD-2674. (AD-231798).

Equations were developed for predicting the effect of natural convection on heat transfer in turbulent flow in vertical tubes. The effect of natural convection was to flatten the velocity profile, and this effect is negligible except at high Grashof numbers (Gr). The critical value of Gr is a function of the Reynolds' number. Charts were developed for CO_2, showing the specific relation between Nusselt, Reynolds, and Grashof numbers in the critical region. (For preceding period see OOR-2000.1.) (C.J.G.)

22999 WADC-TN-59-185
Midwest Applied Science Corp., Lafayette, Ind.
PERIODIC TEMPERATURE DISTRIBUTION IN LAMINATED SOLIDS. Richard J. Grosh. July 1959. 27p. Project 7063. Contract AF33(616)-5623. ([PB]-161292). OTS.

Periodic heat conduction in plane, cylindrical, and spherically laminated solids is considered. Attention is given to cases of isotropic laminates, with constant product of density and specific heat and space-varying thermal conductivity, after the transient-period state has disappeared. Special attention is paid to treating these problems by matrix methods as suggested by the analogy of this problem with electrical four-terminal networks. Finally, these mathematical methods are used to study the distributed parameter approximation of a plane laminated solid and in this way give some indication of the differences between steady-state and transient measurements of thermal properties for porous insulating materials. The results indicate that, to a first approximation, a definite difference exists. The magnitude of the difference depends on the difference in thermal properties for the matrix and interstice material and the type transient. Nusselt's idealization of porous thermal insulation, a parallel fissured body, was used throughout the calculations. (auth)

23000
ON THE MECHANISM OF TURBULENT MASS TRANSFER IN THE IMMEDIATE VICINITY OF A WALL. E. Ruckenstein (Polytechnic Inst., Bucharest). Acad. rép. populaire Roumaine, Rev. phys. 4, 397-407(1959). (In English)

Two models for turbulent mass transfer have been proposed (Rev. de Chim. 8, 749(1957) and Acad. rep. populare Romine, Inst. fiz., Studii cercetari fiz. 9, 75(1958)), and they are analyzed in the present paper. In the first model it was considered that, because of the turbulence, the fluid layer in the immediate vicinity of the wall is continuously replaced by other fluid "particles", each particle remaining at the solid surface for a short time Δ. It was assumed that the time Δ was sufficiently short in order that the depth of penetration by diffusion be smaller than the thickness $\underline{z_0}$ of the fluid particles. In the present work the case where such a condition is not satisfied is analyzed. In the second model it was considered that a certain part of the liquid of thickness $\underline{z_0}$ flows along the wall a short distance $\underline{x_0}$, after which it mixes with the bulk of the liquid, and that this process is repeated at intervals $\underline{x_0}$ apart. The simplifying hypothesis that the length $\underline{x_0}$ be short enough so that the thickness of the hydrodynamic boundary layer be smaller than or equal to the thickness $\underline{z_0}$ of the liquid layer is considered in this present work. (J.S.R.)

23001
HEAT TRANSFER WITH FLOWING LIQUIDS IN A HORIZONTAL TUBE WITH NATURAL CONVECTION. B. Métais (Technische Hochschule, Karlsruhe, Ger.). Chem.-Ingr.-Tech. 32, 535-9(1960) Aug. (In German)

In the theory of convective heat transfer the influence of the relationship between temperature and substance parameters (viscosity, density) on the heat-transfer index in the transition zone between laminar and turbulent flow has not yet been explained. Therefore, a semi-theoretical equation has been set up for heat transfer with natural convection in a horizontal tube and measurements of the heat-transfer index for water on heating and cooling in a horizontal double-tube heat exchanger have been used to check the equation. (auth)

23002
DEVELOPMENT OF A SIMULATED HIGH-TEMPERATURE NUCLEAR LOOP. J. P. McGee, N. H. Coates, and G. E. Fasching (Bureau of Mines, Morgantown, W. Va.). p.236-53 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

As an aid in the feasibility study of nuclear gasification, an induction-heated experimental loop was constructed and operated to evaluate component performance and to point out areas in which additional development effort is needed. This loop was operated at temperatures up to 2500°F, using helium as the heat-transfer medium. Sustained operation was accomplished in the range of 2100 to 2300°F. Major problems were contamination of the recirculated helium with gases evolved from the materials of construction of the loop, deterioration of oxide-type refractories, and helium recycle at 1000°F. However, redesign of the helium recycle compressor allowed sustained operation in the 700 to 900°F range. (auth)

23003
IMPROVEMENTS IN OR RELATING TO HEAT EXCHANGE SURFACES. Louis Afzal Husain (to United Kingdom Atomic Energy Authority). British Patent 844,167. Aug. 10, 1960.

A technique is given for improving heat transfer between coolant and heat exchange surfaces of reactor fuel elements. This technique consists of inducing artificial turbulence of the boundary layer of static fluid at the surface by attaching a pattern of wires to the surface fins. It is not necessary to attach the wire to the surface along the whole of its length; tack welds at intervals may be used. Zirconium wire is preferred because of its low neutron absorption property; however, carbon filament can be extruded on a cylindrical graphite tube and then graphitized in position. (D.L.C.)

23004
IMPROVEMENTS IN OR RELATING TO STEAM RAISING PLANT. John Mackenzie Mitchell (to General Electric Co., Ltd.). British Patent 844,408. Aug. 10, 1960.

A scheme is given for a dual pressure steam raising plant for reactor power plants, especially those of the Calder Hall type in which heat transfer fluid (CO_2) can be circulated by steam. In the scheme, the gaseous coolant is passed through the steam raising unit and then is passed back into the reactor via a gas blower. The unit employs a dual pressure cycle in which water is passed into two steel drums connected to evaporators and superheaters in the unit; steam from one drum is high-pressure steam (HP), while steam from the other is low-pressure steam (LP). HP drives the gas blower by means of a back pressure turbine and then is discharged into the LP cycle in the unit. HP and LP from the superheaters are fed into a distant turbo-alternator which comprises two turbines, a small one for HP and a large one for LP. (D.L.C.)

Instrumentation

23005 AERE-M-696
United Kingdom Atomic Energy Authority. Research Group. Wantage Radiation Lab., Harwell, Berks, England and United Kingdom Atomic Energy Authority. Research Group. Radiochemical Centre, Amersham, Bucks, England.
A CONSTANT LEVEL DEVICE FOR A SUPER-COOLED LIQUID NITROGEN CONDENSING HEAD. J. Chadwick and K. J. Taylor. May 1960. 8p. BIS.

An automatic device for maintaining super-cooled liquid nitrogen at a constant level in a gas liquefaction head is described. (J.R.D.)

23006 AERE/X/PR/2357(Final)
Rover Co., Ltd. Meteor Works, Solihull, Warwicks., England.
DESIGN, DEVELOPMENT & SUPPLY OF A TWIN ROTOR NEUTRON SPECTROMETER THERMAL NEUTRON ANALYSER AND ROTORS FOR THESE EQUIPMENTS. Final Technical Report. J. R. Pickles and R. Hazlewood. Sept. 30, 1959. 138p. Contract CON/HAR/EMR/75.

The drive unit and other parts of the two machines which were designed and manufactured for experiments at Harwell and Chalk River are described briefly. A treatise is presented on the design of neutron choppers, to which most of the design time was devoted. (W.D.M.)

23007 AFOSR-TN-60-509
California. Univ., Berkeley. Electronics Research Lab.
BEHAVIOR OF A FIELD-SWEPT MASER OSCILLATOR. J. C. Kemp. Apr. 19, 1960. 31p. Contract AF49(638)-102.

The behavior of the radiation field arising in a field-swept two-level maser oscillator is treated theoretically. The amplitude-modulation pattern to be expected under the conditions (rapid sweep, or slower sweep with "weak" oscillation, i.e., $\beta > 1/8\pi$) when the modulation should be most pronounced is predicted. The operation of a field-swept maser oscillator which used as paramagnetic sample a calcite crystal containing color centers produced by neutron bombardment, and based on a two-frequency arrangement involving a bimodal cavity is discussed. Experimental waveforms were in satisfactory agreement with theoretical predictions. (C.J.G.)

23008 AFOSR-TN-60-702
Aerojet-General Corp., Azusa, Calif.
THE DEVELOPMENT OF A MASS SPECTROMETER FOR ION STUDIES. R. J. Sunderland and J. R. Radbill. June 1960. 23p. Contract AF49(638)-214. (TN-35).

Mechanisms for the production of positive ions on metallic and nonmetallic surfaces were investigated. In order to determine the mass spectrum of the emission from a particular source, a magnetic-sector-field mass spectrometer was constructed. This instrument is a first-order-focusing type, having a 60°-sector magnetic field in which the ion trajectories have a 5-in. radius of curvature. The spectrometer is constructed entirely of metal, with the central portion of the tube forming the pole faces of the magnet, which has high-impedance windings. The magnet-current power supply, regulated to 1 part in 10^4, is capable of generating fields greater than 16,000 gauss in the focusing region. The precision accelerating voltage is also regulated to 1 part in 10^4 up to 15 kv at 10 ma. The system is evacuated by a 6-in. oil-diffusion pump which is well trapped with liquid nitrogen; pressures throughout the system are of the order of 10^{-6} mm Hg. The instrument was designed primarily to investigate the mass spectrum of ions produced thermally on surfaces. Since such sources usually evolve neutral gases at high rates, the spectrometer is pumped from the source end through a 3-in.-ID coupling adjacent to the ion source. Positive-ion masses in the range from 6 to 184 amu and negative ions with masses of about 150 amu were studied with this instrument. The resolving power of the system is approximately 200 for thermally produced positive ions. (auth)

23009 CISE-74
Centro Informazioni Studi Esperienze, Milan.
TECNICHE, APPARECCHIATURE E DATI SPERIMENTALI PER L'ANALISI CHIMICA E RADIOCHIMICA. I. MISURE QUANTITATIVE CON SPETTROMETRIA GAMMA MEDIANTE SCINTILLATORI (NaI) IN GEOMETRIA VARIABILE O 4π. (Technique, Apparatus, and Experimental Data for Analytical Chemistry and Radiochemistry. I. Quantitative Measurement with Gamma Spectra using NaI Scintillators in Variable or 4π Geometry). C. Triulzi. May 1960. 18p.

In normal routine laboratory work in radiochemistry, measurements of gamma-emitting isotopes are essential. In particular, quantitative measurements require knowledge of the efficiency of the measuring system. A collection of data is presented for calibration of two devices, based on the use of scintillators. A table is given of gamma energy measurements for a number of isotopes ranging from 0.122 to 1.33 Mev. The results obtained in calibrating a NaI crystal $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in. are then given. (T.R.H.)

23010 CISE-75
Centro Informazioni Studi Esperienze, Milan.
TECNICHE, APPARECCHIATURE E DATI SPERIMENTALI PER L'ANALISI CHIMICA E RADIOCHIMICA. 2. GRAFICI E TABELLE DI USO CORRENTE PER MISURE DI EMETTITORI BETA MEDIANTE CONTATORI DI GEIGER. (Technique, Apparatus, and Experimental Data for Analytical Chemistry and Radiochemistry. 2. Graphs and Tables Currently Used for Measurement of Beta Emitters Using Geiger Counters). A. Scaroni and C. Triulzi. June 1960. 27p.

Results are presented of a comparison of a series of G. M. counters of the intercapedine type made at CISE. Efficiency curves are given for β particles ranging from 0.3 to 3.5 Mev. Then the curves of percent efficiency of an end-window G. M. counter versus source distance for isotopes now in use are given along with curves of percent β transmission in low-atomic-number materials. (T.R.H.)

23011 CNC-34
Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.
CONTATORI A SCINTILLAZIONE. (Scintillation Counters). A. S. Figuera and A. Serra. [195?]. 75p.

The main parameters characterizing a scintillation counter are outlined. Specifically, problems are discussed involving light collection from thin scintillators and light-pipes design. The principal theoretical results about P. M. operation under pulse conditions and the results of a series of measurements designed to determine the work condition in which to have the best signal/noise ratio in RCA 6810A and RCA 6342 photomultipliers, are discussed. (auth)

23012 CRRD-858
Atomic Energy of Canada Ltd., Chalk River, Ont.
A MONITOR FOR AIRBORNE TRITIUM. G. Cowper and S. D. Simpson. July 1960. 15p. (AECL-1049). AECL.

A monitor was designed which is suitable for the measurement of concentrations of tritium in air in the presence of a fluctuating background of γ radiation. The monitor uses a pair of compensated ion chambers and operates satisfactorily in γ-radiation fields of several milliroentgens per hour without the use of shielding. The monitor consists of a pair of symmetrical ionization chambers with the common collector electrode connected to an electrometer d-c amplifier. Room air, after passing through a dust filter and an ion trap, is drawn through one ion chamber which responds to background γ radiation plus gaseous radioactivity while the other ion chamber being sealed from the surrounding air responds only to background γ radiation. Because of the opposite polarization of the two chambers, the d-c amplifier measures only the net ionization contribution from the gaseous radioactivity. (W.L.H.)

23013 HW-65036
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A MINIATURE BETA SCINTILLATION DETECTOR. Roy A. R. Kent and Edwin M. Sheen. May 4, 1960. 15p. Contract AT(45-1)-1350. OTS.

A miniature light pipe and beta scintillation detector probe $^{3}/_{16}$ inches in diameter and 4 inches long was developed and tested. The probe was designed with an anthracene detector, a polished fused-quartz light pipe, and a stainless steel light-pipe housing with a double aluminum coated mylar probe end window. The container could be held in one hand if desired, but for most applications would be mounted on a ring stand or tripod. The probe was calibrated both with point sources and with nuclides in aqueous solution. (M.C.G.)

23014 HW-65802
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A PRECISION CURRENT INTEGRATOR. I. T. Myers and G. T. Orton. Feb. 16, 1960. 11p. Contract AT(45-1)-1350. OTS.

A high precision beam current integrator that was built for use with a 2 Mev Van de Graaff electron accelerator is described. Integrated currents in the microampere region may be measured to accuracies of ±0.05%. The current range is 10^{-3} to 40 μa. (auth)

23015 JAERI-1009
Japan Atomic Energy Research Inst., Tokyo.
MEASUREMENT OF THERMAL-NEUTRON ABSORPTION CROSS-SECTION WITH A PILE OSCILLATOR. Report No. 9. Toyojiro Fuketa and Shoichi Ōtomo. Mar. 1960. 26p.

JRR-1, a water-boiler type reactor of 50 kw, is equipped with a pile oscillator for the purpose of thermal-neutron absorption-cross-section measurements and material assays. The oscillator has run since 1958; its performance is described. Some introductory discussions and an outline of the apparatus are given. (auth)

23016 SCDR-204-60
Sandia Corp., Albuquerque, N. Mex.
A METHOD FOR CALCULATING THE CUTTING FORCE COMPONENT PARALLEL TO THE PLANE OF MOTION OF THE CUTTER. C. I. Millard. Aug. 1960. 6p. OTS.

The variables involved and a procedure to follow in calculating the cutting force component acting in the plane of motion of a cutter used in an energy absorbing device are presented. (auth)

23017 SCTM-237-60(52)
Sandia Corp., Albuquerque, N. Mex.
INSTRUMENTATION APPLICATION OF CARRIER-ERASE MAGNETIC-TAPE RECORDING. R. S. Reynolds. Aug. 4, 1960. 10p. OTS.

Carrier-erase recording is used in instrumentation systems which require small, simple, magnetic-tape recorders. The carrier-erase recording process is described and presents guide lines for the application of such systems. (auth)

23018 UCRL-5964-T
California. Univ., Livermore. Lawrence Radiation Lab.
STANDARDIZATION IN THE DESIGN AND CONSTRUC-

TION OF ELECTRONIC INSTRUMENTATION AND CONTROL SYSTEMS. J. G. Nish. [1960?]. 37p. Contract [W-7405-eng-48]. OTS.

Design and construction of elaborate electronic systems for instrumentation and control of test and research facilities were carried out. This design and construction was guided by principles and practices of standardization which reduced system cost and completion time. These standardization principles and practices are summarized. The basic design principles were: all instrumentation mounted in relay racks joined together to form a continuous wall; all testing and checking, as far as practicable, made possible from this single control center; provision of a central-point check of the safety of the entire system; and power feed and controls concentrated on a single rack of the multiple rack installation and arranged inside the rack for maximum safety. Construction standardization was achieved by making both the racks and the panel or chassis units mounted on them of modular design. (M.C.G.)

23019 AEC-tr-4075

NEW AIR FLOW SEPARATOR FOR FINE DUSTS. Zurlo. Translated from a paper presented at the "Quatrieme Colloque sur les Poussieres Institut National de Securite, March 28-30, 1957." 16p. JCL.

An air flow separator designed to facilitate the dry fractionation of dust into four or more grain sizes is described. These may be sampled after being sieved through 400 mesh in the laboratory, or from the air in working areas where dusts are in suspension at the sampling time. Diagrams and calculations are included along with results of experimental quartz dust separations. (J.R.D.)

23020 AEC-tr-4180

THERMOCOUPLE AND PYROMETER CONTAINING SUCH A THERMOCOUPLE. C. H. W. Clark and J. A. Sugden. Translated from Swedish Patent No. 123920. Dec. 2, 1948. 5p. JCL.

A thermoelectric device consisting of a junction between two dissimilar materials which produce an electromotive force under the action of heat is described. One electrode of this thermocouple consists of a ceramic material that contains titanium dioxide having electrical conductance, and the other electrode consists of a conductive nonmetallic material or a metal. The thermocouple produces a greater electromotive force for a specified temperature rise than does a thermocouple with electrodes composed of two unlike metals or carbon—silicon carbide. (J.R.D.)

23021 CEA-tr-R-821

ENREGISTREMENT AUTOMATIQUE DE L'INTENSITÉ DES RAYONNEMENTS RADIOACTIFS. (Automatic Recording of the Intensity of Radioactive Radiation). V. N. Afanas'ev (Afanassiev). Translated into French from Pribory i Tekh. Ekspt. No. 3, 36-40(1957). 12p.

A method and apparatus are described for automatic recording of the intensity of radiation, based on measurement of the time required for counting a given number of pulses. A counting tube is connected through a preamplifier to a counter block. The counter block is connected by an automation block (relay) to the movement inversion mechanism which mechanically operates the recording pen. The device has the advantages of operational stability, ease of recording weak intensities, and simplicity of the recording mechanism. The principal defect is in the relative complexity of the counter block. (T.R.H.)

23022 JPRS-2771

PORTABLE PNEUMATIC OSCILLOGRAPH AND SMALL (PORTABLE) MECHANOCARDIOGRAPH. S. T. Tsukkerman. Translated from Izvest. Vysshikh Ucheb. Zavedeniĭ, Priborostroenie No. 3, 56-63(1959). 10p. OTS.

The design of a pneumatic oscillograph is described in which the pressure to be measured is directly conducted to mirror pressure gages. These gages effect the recording of pressure data. The pressure range of the device is from less than 1 mm of water pressure to hundreds of kg/cm^2. A similar device which uses analogous parts called the mechanocardiograph, is also described. This modification of the oscillograph is designed for medical uses and is capable of making simultaneous recording from four pick-offs. (J.R.D.)

23023

STUDY OF INCORPORATION OF COMPOUNDS OF BORON AND LITHIUM IN NUCLEAR EMULSIONS. V. Labau and M. Nicolae (Academia R.P.R., Bucharest). Acad. rep. populare Romîne, Inst. fiz. atomica şi Inst. fiz. Studii cercetari fiz. 9, 231-40(1958). (Translated from Referat. Zhur. Khim. No. 20, 1959, abstract No. 72515).

A procedure was studied for incorporating salts of boron and lithium in the emulsion layer of NIKFI K plates having a thickness of 100 μ and for processing them for the determination of neutron flux. The plates were impregnated for 1 hour at 24°C with solutions of boron and lithium compounds, which contained 4 to 65 mg/ml of boron or 0.8 to 10 mg/ml of lithium at a pH from 6.6 to 6.8. Under these conditions a curve of the content of boron and lithium in 1 ml of the emulsion was plotted, and a study was made of changes in the properties of emulsion depending upon concentration. In this manner NIKFI K plates which were 100 μ thick and which contained 10 to 120 mg boron per 1 ml emulsion, and 3.5 to 20 mg/ml of lithium, which could be used for relative determinations of neutron fluxes, were obtained. For absolute determinations of these fluxes it was necessary to calibrate the plates beforehand with a standard source.

23024

DENSITOMETER WITH SEMI-CONDUCTORS FOR FILM DOSIMETRY. D. Pavelescu and I. Iliuc. Acad. rep. populare Romîne, Inst. mecan. apl. "Traian Vuia," Studii cercetăr. mecan. apl. 11, 515-21(1960). (In Rumanian)

A densitometer designed as a differential bridge is described. This design is a simpler solution than that obtained using photoelectric cells with external effect. The method of use with films, which allows the dose to be read in millirems, is discussed. (auth)

23025

CONTROLLED-POTENTIAL POLAROGRAPHIC POLARIZING UNIT WITH ELECTRONIC SCAN AND LINEAR RESIDUAL CURRENT COMPENSATION. M. T. Kelley, D. J. Fisher, and H. C. Jones (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 1262-5(1960) Sept.

A polarographic polarizing unit is described that has electronic scan, linear residual current compensation, and potential-control circuits. The performance of the electronic-scan circuit is superior to that of a conventional motor-driven multiturn potentiometer scanner. The use of this polarizing unit is particularly advantageous for high-sensitivity polarography, both regular and derivative. (auth)

23026

FURTHER DEVELOPMENT OF THE TWO-STAGE MASS SPECTROMETER FOR ISOTOPIC ANALYSIS OF URANIUM. L. A. Dietz, C. F. Pachucki, J. C. Sheffield, A. B. Hance, and L. R. Hanrahan (Knolls Atomic Power Lab., Schenectady, N. Y.). Anal. Chem. 32, 1276-8(1960) Sept.

Precise, absolute abundance measurements for nuclear reactor problems were accomplished through improved ion source optics and development of a fast pulse-counting technique for electron multiplier detection of positive ions. Voltage discrimination for the isotopic ratio U^{238+}/U^{235+} was approximately 0.1% for 15-kv ions. Counting loss for random events was 15% at an observed rate of 10^8 c.p.m. Use of getter-ion pumps and a commercially available electron multiplier simplified operation and maintenance. (auth)

23027

QUENCHING OF FLUORESCENCE IN LIQUID SCINTILLATION COUNTING OF LABELED ORGANIC COMPOUNDS. C. T. Peng (Univ. of California Medical Center, San Francisco). Anal. Chem. 32, 1292-6(1960) Sept.

A method is reported for correcting fluorescence quenching in liquid scintillation counting without the use of an internal standard. The quenching constant or half-quenching concentration, which expresses the quenching property of a compound, was found to vary with instrumental amplification of the pulse signal and particle energy. The non-quenchable fraction of the background count was also analyzed. (auth)

23028

DENSITY AND THICKNESS MEASUREMENT BY GAMMA PENETRATION PROCEDURES USING SCINTILLOMETERS. A. Trost. Atompraxis 6, 121-4(1960) Apr.-May. (In German)

Gamma radiation makes it possible to measure the density of fluids, opaque suspensions, and bulk goods in closed tubes and containers and the thickness of sheet metals without touching the object to be measured. Radiation attenuation, statistics, and constancy of the measuring apparatus determine its accuracy; these factors are discussed. An industrial scintillometer system is described; it has a new type of stabilization, which registers density changes with an accuracy of ±0.001 g/cm^3. The dependence of density on temperature can be compensated in many cases. The thickness of a steel plate between 10 and 100 mm can be measured during the rolling process. Up to a thickness of 40 mm, the accuracy is ±0.1 mm. (auth)

23029

NUCLEAR INSTRUMENTATION OF REACTORS. W. Zumach. Atompraxis 6, 158-63(1960) Apr.-May. (In German)

The problems of radiation monitoring arising in the operation of reactors are described. Starting from the activation of the coolant, a description of several possibilities of detecting activity in fluid or gaseous cooling media is given. In this connection, some formulas are given which make it possible to constitute the connection between the signal (pulse rate or current) and the concentration of activity. (auth)

23030

AN AMPLIFIER WITH DISCRIMINATOR FOR PROPORTIONAL COUNTERS. J. Schintlmeister (Lehrstuhl für Kernspektroskopie der Technischen Hochschule, Dresden). Atompraxis 6, 271-2(1960). (In German)

An amplifier with a discriminator is described for counting α rays with a proportional counter. In connection with a BF_3 proportional counter, it withstood a long test as a neutron monitor. (auth)

23031

DOSE MEASUREMENT. PART V. MEASURING CHAMBERS FOR UNIVERSAL DOSE MEASUREMENT AND THEIR APPLICATION. Atompraxis 6, Attachment to No. 6 (1960) June. (In German)

The importance of selecting the right type of ionization chamber and using it properly is pointed out. The characteristics of different types are given. These include thimble, soft radiation, phantom, and condenser. Descriptions are given of correct procedures for single-dose, surface-dose, and whole-body dose measurement. (T.R.H.)

23032

ELECTRON BACKGROUND IN NUCLEAR EMULSIONS. V. D. Hopper and Jean E. Laby (Univ. of Melbourne). Australian J. Phys. 13, 202-4(1960) June.

The electron background of Ilford G5 electron-sensitive nuclear emulsions was studied for 3 × 2-in., 600-μ thick plates packed in cardboard and wooden boxes and shipped by air at 10,000- to 20,000-ft altitudes and by sea to Australia. The results show that plates arriving by air are more prone to excess radiation damage although 2 out of 60 plates shipped by sea gave exposures >25 mr. (D.L.C.)

23033

EFFICACY OF PULSE-ADDING SPECTROMETER FOR GAMMA-RAYS. J. Kopecky and J. Kajfosz. Československ. časopis pro fysiku 9, 112-13(1959). (Translated from Referat. Zhur. Khim. No. 24, 1959, abstract No. 86375).

A study was made of the dependence of efficacy η_s of a scintillation spectrometer on the energy (E) of radiation. It is shown that η_s decreases with increasing E only up to 3.5 Mev; at higher values η_s increases again. The relatively high value of η_s in the 0.1 to 10 Mev range is a very advantageous characteristic of the spectrometer type under study.

23034

SYSTEM FOR RECORDING α RADIOACTIVITY IN THE BLOOD OF RATS. Jacques Lafuma (Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 247, 1788-9(1958) Nov. 17. (In French)

The passage of an inhaled α-emitting aerosol in the blood was measured in a cell set in a by-pass on the carotid. One wall of the cell consisted of the window of a proportional counter. Since the background of the instrument was less than 2 impulses/h, 10^{-5} μc/ml of an α-emitter of 5 Mev could be easily detected in spite of the short path of α rays in the blood. (auth)

23035

SYSTEM FOR RECORDING β RADIOACTIVITY IN THE BLOOD OF RATS. Georges Michon (Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 247, 1789-92(1958) Nov. 17. (In French)

A blood by-pass was set up on a carotid and the blood passed through one or two cells so designed that a thin-window Geiger-Mueller counter detected the particles emitted by the blood. By means of this system 10^{-3} μc/ml of blood were detected for a β-emitter of maximum energy 0.6 Mev. It also allowed differential recording for two radioelements with different radiation energies. (auth)

23036

ALUMINUM OXIDE CAPACITORS TAKE 500 C. CONSTRUCTION USES HIGH-OXIDE CERMET. Electronics 33, No. 34, 76; 78-9(1960) Aug. 19.

The use of a new anode material permitted operation of an anodically formed aluminum oxide dielectric in a stacked- or wound-foil construction at 500°C. Capacitance values to 0.06 microfarad and insulation resistances of 40 megohm microfarads were obtained. Methods used in the preparation of the electrode material were discussed. Stacked- or wound-foil construction permitted operation in excess of 1,000 hr at 500°C with insulation resistances consistently at 1 to 10 megohm microfarads and higher. Another characteristic of the capacitors is their improvement in insulation resistance at high temperatures. (B.O.G.)

23037

MULTIBEAM CATHODE-RAY TUBE AIDS SHOCK-WAVE

STUDIES. Lloyd Mancebo (Univ. of California, Livermore). Electronics 33, No. 35, 51-3(1960) Aug. 26.

A multibeam cathode-ray tube which displays a raster of 39 traces originating from separate electron injectors was developed. A spherical lens system was designed that focused the beams from the multiple injectors and gave a common crossover point permitting a single pair of deflecting plates to sweep all the beams. Miniature, grid-controlled electron injectors were fabricated. The tube with a time resolution of one part per thousand excelled in one-shot, fast-transient, diagnostic work. The tube consisted of vacuum envelope, 39 electron injectors, field-forming electrodes within a spherical lens, a pair of horizontal deflection plates, and a phosphorescent screen. The tube and circuits were tested with an exploding gas contained in a cylindrical chamber. (M.C.G.)

23038

CONTINUOUS CONTROL INSTALLATION FOR THE β ACTIVITY OF WASTE LIQUIDS. M. Boisseau, P. Cohen, and G. Wormser (Center d'Études Nucléaires, [Saclay, France]). Energie nucléaire 2, 160-5(1960) May-June. (In French)

The installation for the continuous monitoring of the β activity of the "inactive" waters of the hot lab at Saclay is described. The sensitivity of the apparatus (immersion counter), 2×10^{-6} $\mu c/cm^3$ for $Sr^{90} + Y^{90}$, is sufficient in the case studied. The installation has operated for two years in a satisfactory manner. (tr-auth)

23039

APPARATUS FOR AUTOMATIC RECORDING OF STATIONARY FIELD ISODOSES. R. Birkner, H. Bradaczek, F. Kossel, and G. Pohle (Städtische Krankenhaus Moabit, Berlin). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 93, 216-30(1960) Aug. (In German)

To plot isodose curves in a tissue-equivalent phantom is a time consuming operation. This is particularly disturbing in practical work when the working out of an individual dosage is required which takes into account the particular anatomical conditions of the individual patient. An apparatus has, therefore, been constructed which automatically registers the dose distribution in any plane section through the isodose volume corresponding to a particular field. A description is presented of the technical conditions that must be fulfilled by such a measuring apparatus in order to meet the requirements of radiation therapy. An account is given of the construction of the device and of the way in which measurements are carried out. Some examples illustrate the operation of the instrument. The apparatus can be used not only in deep-ray therapy but to record the dose for any field of irradiation for which the dose is constant over the time of the measurement. (auth)

23040

DETERMINATION OF LIQUID SCINTILLATION COUNTING EFFICIENCY BY PULSE HEIGHT SHIFT. L. A. Baillie (Sinclair Research Labs., Inc., Harvey, Ill.). Intern. J. Appl. Radiation and Isotopes 8, 1-7(1960) May. (In English)

A method was developed by which liquid scintillation counting efficiency can be determined simultaneously with the count. The two scalers of a liquid scintillation spectrometer are set to count simultaneously different parts of the spectrum. The ratio between the counts on the two scalers can be used as an accurate index of the counting efficiency on one of them. This method saves considerable time compared with the conventional internal standard method and appears to be of equal or greater accuracy. (auth)

23041

THE DESIGN AND APPLICATIONS OF A DEMOUNTABLE 4π GEIGER-MÜLLER COUNTER. L. K. Burton and N. G. Trott (Royal Cancer Hospital, London). Intern. J. Appl. Radiation and Isotopes 8, 20-8(1960) May. (In English)

An improved 4π G.M. counter was designed from which the cathode could be easily removed, leaving the anode wires intact and still under tension. Counters of this type have been used successfully for several years in the measurement of radioactive nuclide standards. Results of intercomparisons of standards with other laboratories were presented. The counters were also used in conjunction with γ-ionization measurements in determining the specific γ-ray emission (k-factor) for Fe^{59}, Cs^{137}, and Ir^{192}. Applications of these counters in biological and medical work were described. (auth)

23042

A NEW TYPE OF LIGHT-TIGHT HOUSE FOR α-SCINTILLATION COUNTERS. U. Hollstein and H. J. Akkerman (Instituut voor Kernphysisch Onderzoek, Amsterdam). Intern. J. Appl. Radiation and Isotopes 8, 60(1960) May. (In English)

A new type of light-tight house for α scintillation counters was described. The sample was rotated between filling and counting positions. The penetration of light onto the photomultiplier was under all circumstances prevented by means of a simple foolproof locking mechanism. The efficiency of the counter amounts to 47% and the background to 0.1 counts/min. (auth)

23043

ELECTRONIC EQUIPMENT FOR IN-FLIGHT PROCESSING OF ROCKET-BORNE MASS SPECTROMETER DATA. J. H. Wager (Univ. of Birmingham, Eng.). J. Electronics and Control (1) 8, 227-40(1960) Mar.

A data sampling technique is employed in order that the high-frequency signals obtained from a time of flight mass spectrometer may be transmitted over a narrow band telemetry link. By comparing the instantaneous amplitude of two sawtooth waveforms, a strobing pulse is obtained which scans the high-frequency signal after amplification. By feeding the output of the strobing circuit to a low-pass filter, a slow-speed version of the original signal is formed. A simple transistor pulser to produce fast pulses in a capacitive load is also described. (auth)

23044

HIGH VACUUM HIGH TEMPERATURE X-RAY CAMERA. B. A. Hatt, P. J. C. Kent, and G. I. Williams (Fulmer Research Institute Ltd., Stoke Poges, Bucks, Eng.). J. Sci. Instr. 37, 273-6(1960) Aug.

A camera suitable for the examination of reactive metals such as titanium and zirconium up to temperatures of 1000°C in a vacuum better than 1×10^{-6} mm of mercury is described. The high vacuum is obtained by constructing the camera in glass without demountable seals and using a radiant heater in place of a conventional furnace assembly. Application of the camera to studying the $\beta-\alpha$ transformation in Ti—Cr and Ti—Zr alloys is described. (auth)

23045

MAGNETIC MASS SPECTROMETER. L. Furman. "J. Stefan" Inst. Repts. (Ljubljana) 4, 109-15(1957). (Translated from Referat. Zhur. Fiz. No. 6, 1959, abstract No. 12260).

A magnetic mass spectrometer for the isotopic analysis of gaseous substances is described. The ions are formed in the source by electron bombardment. Electron current up to 300 μamps is used. The ions are separated by their m/e ratio in a homogeneous sector (120°) magnetic field.

The radius of curvature of the trajectory of the ions is 150 mm. The mass spectrum can be scanned by changing both the magnetic field and the ion energy. In the latter case rapid scanning is possible and up to 100 lines can be observed simultaneously on the oscillograph screen. The ion collector is connected with an electrometric amplifier, which has 100% negative feedback and an input impedance of 10^{11} ohms. The use of an RC network in the feedback made it possible to compensate for the electric capacitance and to expand the bandwidth of the entire recording system (with the exception of the automatic recorder) to 2 kcs. The noise of the amplifier at the output is not more than 0.5 mv; null drift is less than 5 mv/hr. The resolving power is approximately 400.

23046

A SINGLE UNIT UTILIZING "READ-OUT" IMPULSE USED AS A RADIOACTIVITY LEVEL ALARM. Jiří Mackû and Vlastimil Slouka (Charles Univ., Prague). Jaderná energie 6, 204(1960) June. (In Czech.)

A radiation alarm circuit was developed for use as a monitor together with a "read-out" counter. This gives an audible alarm at a preset radiation level. The diagram of the integrating or count rate circuit is given. The sensitivity of the instrument can be adjusted from 10 to 100 μc. (TTT)

23047

A DEVICE FOR AUTOMATIC GAMMAGRAPHY IN CLINICAL ISOTOPE INVESTIGATIONS. N. A. Gabelova, O. G. Arakelov, E. T. Martusov, and F. M. Lyass (Inst. of Biological Physics, Academy of Sciences, USSR). Med. Radiol. 6, No. 6, 61-4(1960) June. (In Russian)

A detailed description is given of a device for automatic gammagraphy in clinical isotope investigations. (auth)

23048

NUCLEAR MAGNETIC RESONANCE PULSE APPARATUS. Tsuneo Hashi, Akira Hirai, Masahumi Sasaki, and Takao Kawai. Mem. Coll. Sci., Univ. Kyoto, Ser. A 29, 205-12 (1959) Sept. (In English)

A detailed description of a nuclear magnetic resonance pulse apparatus is given. This apparatus is intended for measuring the spin-lattice relaxation time of proton in high polymer between 10 and 1,000 msec. (auth)

23049

THE RADIOACTIVITY OF OPTICAL INSTRUMENTS WITH CONSTITUENT PARTS OF POTASSIUM BROMIDE. J. Braunbeck (Bodeneewerk Perkin-Elmer & Co. G.m.b.H., Überlingen, Ger.). Naturwissenschaften 47, 353(1960). (In German)

Optical instruments which contain parts of potassium bromide are sources of radiation. A study was made to determine the extent of the effect on radiation detection instruments placed near infrared instruments with potassium bromide prisms. The results showed that a one-meter separation of prism and counter is sufficient for the detector to be unaffected by the radiation. The use of strongly β-absorbing housing for the counter also reduces the radiation effects. (J.S.R.)

23050

GAS IONIZATION DETECTORS. A Survey. W. R. Loosemore (Atomic Energy Research Establishment, Harwell, Eng.). Nuclear Power 5, No. 52, 84-9(1960) Aug.

A survey is presented which is considered a supplement to a series of articles concerning the characteristics of gas ionization detectors. The characteristics are given in tabular form according to the four main types—Geiger-Müller counters, proportional counters, mean current ionization chambers, and pulse ionization chambers. The tables are further sub-divided into types and manufacturers. (B.O.G.)

23051

CONICAL PLASTIC SCINTILLATORS SHOW TOTAL GAMMA ABSORPTION. Gerald J. Hine and John A. Cardarelli (Veterans Administration Hospital, [Boston] and Boston Univ. School of Medicine). Nucleonics 18, No. 9, 92; 94; 96; 98; 100(1960) Sept.

Total photon absorption, at least with low energy γ and x rays, was observed in plastic scintillators. The best results were obtained with lead-loaded, conically-shaped scintillators surrounded by aluminum oxide as a reflector. Low energy photons gave better absorption curves even poorer resolution than the higher energy photons. The best scintillation size for total absorption was found to be a function of energy. Surrounding the scintillator with aluminum oxide instead of aluminum foil increased the pulse height slightly. The light output was increased by changing the shape from a cylinder to a truncated cone. By adding 2 wt. % lead to the plastic, the absorption of 123 kev γ rays was increased by a factor of approximately 16, but reduced light output made resolution worse. (M.C.G.)

23052

DIMETHYL STYRENE YIELDS MORE EFFICIENT SCINTILLATORS. Stanley R. Sandler, Samuel Loshaek, Edward Broderick, and Philip Bernstein (Borden Chemical Co., Philadelphia). Nucleonics 18, No. 9, 102-3(1960) Sept.

Plastic scintillators made with dimethyl styrene were found to give pulse heights up to 60 % higher than those made with unsubstituted polystyrene. Scintillators based on copolymers of dimethyl styrenes with styrene or vinyl toluene gave pulse heights that decreased linearly with styrene or vinyl toluene content. (M.C.G.)

23053

REDUCTION OF SPURIOUS SCATTERING IN ILFORD G-5 AND K-5 EMULSIONS. B. Judek (National Research Council, Ottawa). Nuovo cimento (10) 16, 834-47(1960) June 1. (In English)

In an attempt to reduce the amount of spurious scattering in emulsions, two batches of Ilford G-5 and two batches of Ilford K-5 stripped emulsions, 600 μ thick, were exposed to the 6.2 Bev internal proton beam from the Berkeley Bevatron. The methods of development used included isothermal development at 5°, 10°, and 15°C, and temperature cycle development with the warm stages at 10°, 15°, and 20°C with the plates immersed in a boric acid-potassium bromide solution. For comparison some emulsions were also developed by "dry," warm development at 25°C. As a further precaution against distortions, potassium alum hardener was added to the fixing bath, and the emulsions were dried slowly at a temperature below 10°C. Scattering measurements performed on the 6.2 Bev proton tracks in the emulsions show that spurious scattering was reduced to about half the value usually obtained. This applies to all the plates, except for a G-5 emulsion from one batch that was developed at 25°C. It was observed that the amount of spurious scattering depends on the development temperature. It does not change between temperatures of 5° and 10°C. Above 10°C there is a gradual increase with temperature. In some emulsions a marked increase of spurious scattering occurs at a temperature of about 25°C. Some variation in the amount of spurious scattering present in the different batches of emulsions used was observed, but there appears to be no difference in that respect between the G-5 and the K-5 emulsions. Good grain densities on minimum tracks and improved uniformity of development with depth in both the G-5 and the K-5 emulsions were obtained using the temperature cycle methods of development with warm stages at 10°, 15°, and 20°C. (auth)

23054

CYLINDRICAL CHAMBER FOR FAST NEUTRON SPECTROMETRY. N. P. Glazkov. Pribory i Tekh. Ekspt. No. 3, 16-19(1960) May-June. (In Russian)

A simple, non-mechanical method is suggested for collimating the nuclear recoil of hydrogen, deuterium, or helium in a cylindrical chamber utilizing the whole volume of the chamber. (tr-auth)

23055

ON THE ERRORS IN MEASURING MONOCHROMATIC γ RADIATION INTENSITY BY SCINTILLATION SPECTROMETER. R. M. Kogan (Inst. of Applied Geophysics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 19-22(1960) May-June. (In Russian)

An expression is developed for evaluating the statistical error in scintillation measurements of monochromatic γ intensity, if it is assumed that the pulse amplitude distribution for the photopeak is gaussian and the level of interference near the photopeak remains constant. Conditions for minimum error are determined and the relation between spectrometer parameters and minimum error is established. (tr-auth)

23056

DETERMINATION OF THE ENERGY DEPENDENCE OF HIGH-ENERGY GAMMA QUANTUM RECORDING. V. I. Gol'danskiĭ, O. A. Karpukhin, and V. V. Pavlovskaya (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 23-6(1960) May-June. (In Russian)

The energy dependence of high-energy (35 to 150 Mev) γ recording with coincidence telescopes is analyzed by a new method. The method is based on recording various bremsstrahlung energies from electron scattering at small angles (3°). Data on the incident radiation spectra and on differential cross sections of Compton scattering are correlated to find the energy dependence. The suggested calibration method permits simultaneous irradiation of the total operational telescope surface. (tr-auth)

23057

PARTICLE MASS DETERMINATION BY MEASURING MULTIPLE SCATTERING AND TRACKS IN PROPANE BUBBLE CHAMBER. I. I. Pershin and V. M. Golubchikov. Pribory i Tekh. Ekspt. No. 3, 26-8(1960) May-June. (In Russian)

The constant sagitta method was used in measuring the mass of particles stopping in a propane bubble chamber. The error in the method, when applied to a single, 25-cm π-meson track, did not exceed 25 %. Heavy particle tracks are measured by the length corresponding to a two-fold increase in "signal" over "noise." A table of heavy particle mass measurements is included. (tr-auth)

23058

PRESSURE AND LEVEL GAGE FOR LIQUID HYDROGEN BUBBLE CHAMBERS. Ya. M. Selektor, M. S. Ainutdinov, and S. M. Zombkovskiĭ. Pribory i Tekh. Ekspt. No. 3, 29-31(1960) May-June. (In Russian)

Descriptions are given of a precise gage for pressure measurement in hydrogen bubble chambers. The pressure transducer is switched into the alternating circuit at 200 kc. Variations in transducer capacity shift the measured phases. The transducer is connected to the device with a 40-m high-frequency cable. Variations in the cable capacity do not affect the gage recordings. The zero drift does not exceed 1 % of the scale per hour. The gage can be used also for measuring liquid hydrogen and nitrogen in closed containers. (tr-auth)

23059

MEASUREMENTS OF PARTICLE IONIZATION BY RELATIVE PHOTOMETRY OF PHOTOGRAPHED TRACKS. V. I. Voloshchuk, V. V. Kuznetsov, R. M. Sulyaev, A. I. Filippov, and Yu. A. Shcherbakov (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekh. Ekspt. No. 3, 34-6(1960) May-June. (In Russian)

A method of relative photometry is described for measuring particle ionization in diffusion chambers. (tr-auth)

23060

FAST METHOD OF TRACK SCANNING IN PHOTOEMULSION. B. P. Bannik and M. I. Podgoretskiĭ (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekh. Ekspt. No. 3, 36-7(1960) May-June. (In Russian)

A method of particle track scanning in emulsion at the rate of ~3.5 m/day is described. (tr-auth)

23061

GAMMA RADIATION BACKGROUND EFFECTS ON THE GAS AMPLIFICATION COEFFICIENT IN PROPORTIONAL COUNTER. Yu. M. Tolchenov. Pribory i Tekh. Ekspt. No. 3, 38-41(1960) May-June. (In Russian)

The background influence on the gas amplification coefficient in proportional counters is studied. The background induces an additional current in the counter which reduces the electric field near the filament and causes a drop in the amplification factor. An equation was derived for correlating the gas amplification factor at a given background intensity I_γ, with the gas amplification magnitude in the absence of background and with counter parameters. The results are in good agreement with the experiment. (tr-auth)

23062

DIFFERENTIAL GAMMA CHAMBER OF ALTERNATING PRESSURE. A. B. Dmitriev. Pribory i Tekh. Ekspt. No. 3, 42-4(1960) May-June. (In Russian)

The spectral sensitivity exhibited by a geometrically divided differential chamber was utilized for recording the composition and purity of γ-emitting isotopes. (R.V.J.)

23063

FAST NEUTRON DETECTOR WITH LOW SENSITIVITY TO GAMMA RAYS. Yu. V. Dukarevich and A. N. Dumin (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 48-50(1960) May-June. (In Russian)

The design is presented of a fast neutron detector with low γ sensitivity based on the principle of stilbene scintillation induced by electrons and protons. Effective depression of γ counts begins at a proton energy of ~500 kev. The counter is capable of detecting neutrons in a γ background and γ rays in a neutron background as well as distinguishing recoil electron and proton spectra. (R.V.J.)

23064

ON THE METHOD OF ABSOLUTE MEASUREMENTS OF ACTIVITY IN GAS LABELED WITH C^{14} AND S^{35}. M. Yu. Tissen. Pribory i Tekh. Ekspt. No. 3, 51-3(1960) May-June. (In Russian)

A method is suggested for measuring the activity of C^{14}- and S^{35}-labeled gas and vapors with a "free gas" ionization chamber. An analysis is made of the utilization of heavy inert gas (xenon or freon-12) under 1 to 3 atm pressure as the main filler with ~0.5% of the gas to be measured. Such a method demands small chamber dimensions (diameter and height ~100 mm at 3 atm pressure). The order of accuracy is ~±5%. A schematic drawing of the chamber is included. (tr-auth)

23065

1024 CHANNEL PULSE ANALYZER. L. A. Matolin, A. M. Shimanskiĭ, S. I. Chubarov, and I. V. Shtranikh. Pribory i Tekh. Ekspt. No. 3, 54-63(1960) May-June. (In Russian)

A pulse analyzer with a dead-time of ~ 1 μsec is described. The design of the basic assembly is included and count losses at maximum load are evaluated. (tr-auth)

23066

100 CHANNEL AMPLITUDE ANALYZER OF SMALL RESOLVING TIME PULSES. A. A. Sanin, Yen-min Yang, Jih-shang Jang, T'ing-baw Hsiu, Ching-ching Wang, Sung-chiang Hsia, Kuei-liang Tai, and Fu Tsên. Pribory i Tekh. Ekspt. No. 3, 63-7(1960) May-June. (In Russian)

The performance of a 100-channel amplitude analyzer with a ferrite memory device based on non-linear amplitude transformation is described, which reduces resolving time about five fold in comparison to similar analyzers. The mean resolving time of the apparatus is ~ 20 μsec. The capacity of each channel is 10^4 pulses. Amplitude spectra can be recorded on a writing device or observed with an oscilloscope. (tr-auth)

23067

STABILIZATION DESIGN OF PULSE TRANSFORMER PULSE CROSS SECTION AT 1 Mv. I. M. Roife. Pribory i Tekh. Ekspt. No. 3, 67-72(1960) May-June. (In Russian)

Problems in stabilizing trapezoidal pulse cross sections at a maximum pulse intensity of 1 Mev are analyzed. Individual sections of the scheme and the total system were studied. The stabilized pulse transformer of the 10-Bev Dubna synchrophasotron, which produces the pulse stabilization to $\sim 0.05\%$, is described. (R.V.J.)

23068

GENERATOR OF SHORT DURATION PULSES. O. S. Kolotov, Yu. N. Lobanov, A. S. Obukhov, and N. M. Polev (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 3, 73-6 (1960) May-June. (In Russian)

The design and construction of a laboratory generator of rectangular pulses are described. The time interval may be regulated from 0.01 to 0.5 μsec and amplitude up to 2 kv. (tr-auth)

23069

SPECTRAL ANALYZER WITH ELECTRON FUNCTIONAL TRANSFORMER. M. G. Serbulenko and V. M. Matoshin (Inst. of Geology and Geophysics, Siberian Section of the Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 84-6(1960) May-June. (In Russian)

Descriptions are given of a spectral analyzer with arbitrary amplitude-frequency characteristics. Printed functions are introduced by a functional transformer to a cathode-ray tube. The total analysis time, determined by using an electron integrator, is ~ 30 min. The time for the usual analysis is ~ 8 min. The order of error for the first case is 3 to 5 % and for the second case 5 to 7 %. (tr-auth)

23070

HIGH RESOLUTION CONVERSION SCHEMES. V. V. Sokolovskiĭ, G. V. Rukolaine, I. A. Radkevich, and N. S. Rezvyakov. Pribory i Tekh. Ekspt. No. 3, 92-3(1960) May-June. (In Russian)

Two conversion schemes with resolving powers of 0.15 and 1 μsec are described. The schemes were developed for multichannel time-of-flight analysis. (tr-auth)

23071

DEVICE FOR AUTOMATIC RECORDING OF PULSES AT SLOW COUNTING RANGE. A. M. Netsetskiĭ and O. I. Sumbaev (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 93-5(1960) May-June. (In Russian)

A device is described for automatically recording the number of pulses at any slow counting speed. The device is constructed with semiconductors. The order of error in measuring pulse numbers is $\sim 2\%$ at temperatures between 15 and 30°C. (tr-auth)

23072

OMEGATRON WITH PANORAMIC VIEW. N. I. Leont'ev, Yu. K. Udovichenko, and S. V. Kuril'nikov. Pribory i Tekh. Ekspt. No. 3, 100-3(1960) May-June. (In Russian)

An analyzer was designed for the analysis of light masses. The mass spectra may be observed on the screen of a cathode-ray tube. The device uses a small (2.9 kg) magnet with a heterogeneous field. (tr-auth)

23073

A DEVICE FOR MEASURING FLUCTUATIONS OF RADIOACTIVE EMISSION. V. A. Bukarev (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 104-5(1960) May-June. (In Russian)

The design of a device for measuring fluctuations appearing in the integrating RC-chain is described. The device is capable of separately measuring $\bar{\nu}$ and the mean-square value of σ. The relative mean-square fluctuation intensity ρ is determined from the σ and $\bar{\nu}$ values. The maximum measured ρ values are from 2 to 20%. (tr-auth)

23074

MEASUREMENT AND STABILIZATION OF MAGNETIC FIELDS BY MEANS OF ELECTRON CYCLOTRON RESONANCE. L. V. Dubovoĭ, O. M. Shvets, and S. S. Ovchinnikov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Pribory i Tekh. Ekspt. No. 3, 106-9 (1960) May-June. (In Russian)

A method of magnetic field measurement using plasma conductivity at electron synchrotron frequencies is described. The method is based on the determination of electron frequencies, which in turn leads to an evaluation of the magnetic field magnitude. Measurements were correlated with data obtained by the nuclear resonance method. Factors influencing the precision of the method are analyzed. The scheme possesses high stability, and it can be applied for measuring pulsed fields and fields with large spatial heterogeneity. The method is recommended for efficient magnetic field stabilization. (tr-auth)

23075

APPLICATION OF XENON–FREON AND XENON–PROPANE MIXTURES IN BUBBLE CHAMBERS. Ya. Ya. Shalamov and V. A. Shebanov. Pribory i Tekh. Ekspt. No. 3, 141-2(1960) May-June. (In Russian)

The performances of xenon mixed with freon-12(CCl_2F_2) and xenon with propane (C_3H_8) were tested in a 44-cm^3 bubble chamber constructed of stainless steel. The chamber windows were of plexiglass; chamber pressure was 40 atm. Tracks from a 30 μc source were observed. The results show that the time sensitivity of the camera exceeded 30 μsec. Characteristics of the mixtures at 25°C are tabulated. (R.V.J.)

23076

RATE METER IN WILSON CHAMBER STEREOPHOTOGRAPHY. Yu. S. Ivanov and V. E. Yakushkin (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 146(1960) May-June. (In Russian)

A simple method of numbering the stereo frames from a Wilson chamber, which can also be applied in diffusion and bubble chambers, is described. Moreover, by means of the suggested method the stereoscopic images of luminous marks outside the working area of the chamber can be used as reference points. (tr-auth)

23077

THE USE OF RADIOACTIVE ISOTOPES IN THE REGULATION OF FLUID LEVEL. J. Domanus and B. Kaminski. Przemysl Chem. 37, 673-6(1958). (Translated from Referat. Zhur. Khim. No. 20, 1959, abstract No. 71740).

The Warsaw Institute of Electrical Engineering developed a level regulator which is based on attenuation of gamma radiation by a layer of the liquid being regulated. The regulator consists of a source and a receptor of γ radiation which is installed along the same horizontal, straight line, on the opposite sides of the outside of the collector of the liquid. Source and receptor are mechanically linked to each other and can be moved up and down the collector. They can be positioned at the desired level. When the liquid level drops below the preset value the receptor is exposed to a maximum amount of radiation, which after suitable transformation and amplification, actuates the pump that feeds the liquid to the collector. Accuracy of regulation is ±5%. The collector is made of steel. It is 700 mm in diameter and has walls 2 mm thick. The radiation source used is Co^{60} 2 mg Ra equivalent, in the form of a wire 0.8 mm in diameter and 2 mm long. A Geiger-Mueller counter is used as a receptor.

23078

β-ELECTRON EMISSION IN VACUUM AND ITS APPLICATION. P. V. Timofeev and Yu. A. Simchenko (Lenin All-Union Electrotechnical Inst., USSR). Radiotekh. i Elektron. 5, 1197-1202(1960) Aug. (In Russian)

Beta emission in a vacuum and the processes appearing in substances subjected to β bombardment are discussed. High-intensity sources prepared from radioactive isotopes are described and their applications as electron sources are suggested. The problems in utilizing radioisotopes for producing electrons are discussed. (tr-auth)

23079

ABSOLUTE BETA COUNTING WITH GEIGER-MUELLER TUBES. Sara Mabel Abecasis. Rev. fac. cienc. quím., Univ. nacl. La Plata 31, 131-9(1959). (In Spanish)

A method previously developed by Zumwalt for the determination in an absolute form of the decay rate of β-emitting nuclides is presented from the viewpoint of measurement conditions. A study was made of all the factors which arise in the measurement of the absolute activity using a Geiger counter. The correction factors for emissions whose maximum β energy is in the range from 0.3 to 2.3 Mev are graphed. The experimental apparatus and techniques used are described. (tr-auth)

23080

SIMPLE HIGH-RESOLUTION NUCLEAR RESONANCE SPECTROMETER. R. Keuning (Unilever Research Lab., Vlaardingen, Netherlands). Rev. Sci. Instr. 31, 839-43 (1960) Aug.

A description is given of a nuclear magnetic resonance spectrometer using a permanant magnet and very simple electronic circuits. A resolving power of better than one part in 10^6 is obtained with samples of approximately 4.5 mm in diameter. Stability and signal-to-noise are satisfactory. (auth)

23081

INDUCTION APPARATUS FOR THE CONTINUOUS MEASUREMENT OF MAGNETIC SUSCEPTIBILITY. Wallace A. Norder (Tufts Univ., Medford, Mass.). Rev. Sci. Instr. 31, 849-51(1960) Aug.

An induction apparatus is described for measurement of the paramagnetic susceptibility of metals during exposure to gases, specifically hydrogen. Provisions are made for heating to 500°C and for removal or addition of gas during measurement. The device may be adapted for use at low temperatures. (auth)

23082

ATOMIC BEAM E-H GRADIENT SPECTROMETER. B. Bederson (New York Univ.), J. Eisinger, K. Rubin, and A. Salop. Rev. Sci. Instr. 31, 852-3(1960) Aug.

A novel atomic beam magnetic substate selector is described. A potential difference is applied to the insulated pole faces of an inhomogeneous magnet. The resulting E and H fields are then approximately congruent throughout the gap region. A beam atom experiences forces due to its effective magnetic moment and induced electric moment which can be made to balance for particular magnetic substates that are independent of the atomic velocity. State-selected beams of reasonable intensity and purity can thus be obtained. (auth)

23083

INSTRUMENTATION FOR MEDIUM ENERGY GAMMA-RAY SCATTERING MEASUREMENTS. E. L. Garwin and A. S. Penfold (Univ. of Chicago). Rev. Sci. Instr. 31, 853-60(1960) Aug.

A system for the energy analysis of scattered gamma rays of up to 70-Mev energy is described. A 5-in. diam., 4-in.-long NaI(Tl) crystal was the energy-sensitive element. The net amplification between the ten-stage photomultiplier output and the pulse-height analyzer input was 1.8. The pulse-height-to-channel transfer characteristic of the system departs from linearity by less than 0.05 channel between the 50th and 16th channel and by one channel between the 16th and 6th. It is demonstrated that the light-to-voltage transfer characteristic of the photomultiplier is linear up to at least 30-v output levels. Provision for direct determination of the effect of superposed pulses (pileup) is incorporated into the system. Careful shaping of the pulses reduced pileup to a minimum, which was commensurate with obtaining good resolution from the NaI(Tl) crystal. Some typical pulse-height spectra are given, and the novel features of the circuits are described. (auth)

23084

RESPONSE SPECTRA FOR GAMMA RAYS IN CsI. W. F. Miller and William J. Snow (Argonne National Lab., Ill.). Rev. Sci. Instr. 31, 861-2(1960) Aug.

Response spectra for gamma rays incident on cesium iodide (thallium-activated) crystals were calculated for two crystals. The crystals considered were right circular cylinders and the gamma-ray energies were 0.661, 1.83, 2.76, and 3.13 Mev. Comparisons between the response spectra for CsI(Tl) and NaI(Tl) crystals of the same size are presented. (auth)

23085

NEUTRON-INSENSITIVE PROPORTIONAL COUNTER FOR GAMMA-RAY DOSIMETRY. Randall S. Caswell (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 31, 869-71(1960) Aug.

A γ-ray dosimeter with low sensitivity to neutrons was developed for radiation dosimetry in mixed fields of neutrons and gamma rays. Neutron sensitivity in a 2.5- to 3-Mev $H^2(d,n)He^3$ neutron field was shown experimentally to be $\leq 1.2\%$ on the basis of first collision dose in tissue. Gamma-ray sensitivity is independent of energy to within ±5% from 1.25 Mev (Co^{60}) to 200 kev and to within ±20% down to 47 kev. The instrument is a proportional counter that may be used as a dosimeter for γ rays in the presence of neutrons by pulse-height integration of the small pulses due to secondary electrons produced by γ rays and rejection of the large pulses due to heavy particle recoils from neutrons. (auth)

23086

IMPROVED SLOTTED DISK TYPE VELOCITY SELECTOR FOR MOLECULAR BEAMS. Hans U. Hostettler and Richard B. Bernstein (Univ. of Michigan, Ann Arbor). Rev. Sci. Instr. 31, 872-7(1960) Aug.

A slotted-disk type mechanical velocity selector, 10 cm long and 16 cm in diameter and consisting of six disks was constructed and tested. The velocity resolution corresponding to the half-intensity width is 0.047; no velocity sidebands are transmitted. The effective fractional open time to the incident beam is 0.35. At the highest rotor speed used (17,000 rpm) the transmitted velocity is 1.05×10^5 cm/sec. A general theoretical analysis of the transmission and resolution of selectors with disks of finite thickness is presented. The velocity distribution is reported for a molecular beam effusing from an oven equipped with Zacharias corrugated foil exit canals. (auth)

23087

TECHNIQUE FOR USING THE Np^{237} FISSION REACTION AS A DETECTOR FOR FAST NEUTRONS IN A REACTOR. Daniel Binder (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 31, 902-3(1960) Aug.

A multilayer foil was devised for use as a detector of fast neutrons in a reactor and is an extension of Hurst's method using gammas from Np^{237} fission, but it has the advantage of making Hurst's B^{10} shield for Np^{238} γ activity unnecessary. The foil is comprised of a thick nickel foil, a 50-μg/cm^2 neptunium deposit, a 0.3-mg/cm^2 aluminum layer, a 7-mg/cm^2 aluminum catcher, an aluminum control layer, and 30 mils of cadmium. The 0.3-mg/cm^2 aluminum layer traps the Np^{238} recoils from the neptunium (n,γ) reaction while allowing 90% of the fission products to pass into the aluminum catcher. The aluminum control foil restrains the activity from the Al^{27}(n,p) reaction. In order to test the foil assembly for masking the Np^{238} activity, 10-min, 3-day, and 7-day irradiations of Np^{237} in a graphite reactor were carried out and compared with a thermal neutron irradiation of Pu^{239} using Hurst's techniques; agreement is found to be excellent. (D.L.C.)

23088

THIN FIBER SCINTILLATION COUNTER FOR DETERMINING PARTICLE BEAM DISTRIBUTIONS IN ACCELERATORS. R. C. Jopson, R. E. Wright, and Hans Mark (Univ. of California, Livermore). Rev. Sci. Instr. 31, 905(1960) Aug.

Thin fiber scintillation counters for studying particle beams in accelerators were developed using small plastic scintillation fibers made for use in high-energy physics. A fiber of 0.5-mm diameter or less and 1 to 10 cm long is mounted on a long thin (0.5-mm diameter and 20 ft long) two-layer glass pipe; the pipe serves as a light transmitter. The pipe passes through a vacuum seal and is joined to the face of a photomultiplier. Since the pipe is susceptible to radiation damage, it is placed inside a steel tube filled with Woods metal. Using this counter, electrons were shown to be trapped in the Astron E-layer tank for times longer than 1 sec, and estimates of the number of the initially trapped particles were made. (D.L.C.)

23089

DESIGN CALCULATIONS FOR NaI SYSTEMS. W. F. Miller and William J. Snow (Argonne National Lab., Ill.). Rev. Sci. Instr. 31, 905-7(1960) Aug.

The effects of the size of cylindrical NaI(Tl) crystals on its resolution for narrowly collimated γ beams were calculated by a Monte Carlo computer program for 12 crystals of varying size from 4 × 4 in. to 12 × 24 in. with a 0.5-in.-dia. γ beam. The initial γ energy was taken to be 6.07 Mev, and the results were plotted on counts per channel vs. channel number graphs. (D.L.C.)

23090

DETECTION OF MINIMUM IONIZING PARTICLES IN SILICON p-n JUNCTIONS. H. M. Mann and W. W. Managan (Argonne National Lab., Ill.). Rev. Sci. Instr. 31, 908-9 (1960) Aug.

Internal conversion electrons at eight energies from 62.5 kev to 1.046 Mev were resolved in Si p-n semiconductor junction detectors by optimum reverse bias selection, and the optimum line widths were observed. An internal conversion electron spectrum is given for Pb^{207m}. The possibility of using these detectors for detecting minimum ionizing particles is examined on the basis of the optimum line widths, and the depletion layer thickness is tabulated as a function of the voltage. It is concluded that a signal-to-noise ratio of more than 10 to 1 is obtainable with these detectors for detection of minimum ionizing particles. (D.L.C.)

23091

EXPERIMENTAL DYNAMICS OF BUBBLE CHAMBER WINDOW FAILURES. Luciano Guerriero (Massachusetts Inst. of Tech., Cambridge), Irwin Pless, Lloyd Hyman, and David Cronin. Rev. Sci. Instr. 31, 910-11(1960) Aug.

The rate of pressure rise in a safety box positioned in front of the window of a scale-model propane bubble chamber and the velocity of glass fragments in the case of window failure were measured. The ratio of safety box to chamber volume was varied from 4 : 1 to 9 : 1, and window failures were induced by closing off a valve to the chamber and raising the temperature slightly. The pressure rise takes an interval on the order of 3 msec; a similar experiment performed with He gave a time of rise on the order of 1 msec. The glass fragments were found to have a maximum velocity of 200 m/sec. It was decided that a pressurized safety box with a relief valve for pressure release in the event of window failure would be best for the 15-in.-dia. methyl iodide-propane bubble chamber under consideration. (D.L.C.)

23092

COUNTER TELESCOPE MEASUREMENT ON NEUTRON FLUX. S. J. Bame, Jr., Eugene Haddad, J. E. Perry, Jr., R. K. Smith, and Blair Swartz (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 31, 911-13(1960) Aug.

Tables of M are given for calculating neutron counter telescope efficiencies for neutron energies 4, 9, 14, 20, and 30 Mev according to the formula $\epsilon = MP\sigma_T(E)$ when P = number of hydrogen atoms/cm^2 in the hydrogenous radiator and $\sigma_T(E)$ = (n,p) scattering total cross section at neutron energy E. The tables were compiled with the aid of an IBM-704 computer and should be used instead of those in Rev. Sci. Instr. 28, 997(1957), which were done with an IBM-701 computer and were subsequently shown to be slightly in error ($<2\%$). (D.L.C.)

23093

LOW BACKGROUND END-WINDOW GEIGER-MÜLLER COUNTER. Hisanobu Kobayashi. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 54, 16-19(1960) Mar. (In English)

For exact measurement of weak β-ray activities with a G-M counter, it is essential to reduce the natural background count without deteriorating the characteristics of the counter. A special type counter is devised for the purpose. The center wire of the counter is provided with a mica disc guard as a β-ray absorber, dividing the counter into two separate compartments, each serving as an independent counter. With such a counter having a mica end-window of 2 cm in diameter and shielded by lead blocks of 5 cm in thickness, the natural background count is reduced to 2 to 4 cpm by setting anticoincidence between the two component counters. Counters of this type are available for measuring weak β activities. (auth)

23094
GAS-LIQUID RADIOCHROMATOGRAPH. M. I. Yanovskii and G. A. Gaziev. Vestnik Akad Nauk S.S.S.R. 30, No. 5, 27-31(1960) May. (In Russian)

Descriptions are given of the design and performance of a radiochromotograph which combines the separation and identification operations with specific radioactivity measurements. The device uses a Pm^{147} ionization detector for measuring the concentration of vapor escaping from the chromatograph column and a circulating gas counter with amplification for measuring the radioactivity. The device possesses a high sensitivity, (0.001 to 0.0005 μc), accuracy, and a capability of determining the radiochemical composition of multicomponent mixtures within 20 to 30 min. (R.V.J.)

23095
NEW HIGH APERTURE MASS SPECTROMETER FOR THE ANALYSIS OF ATOMIC OR MOLECULAR BEAMS. F. Bernhard (German Academy of Sciences, Berlin). Z. angew. Phys. 9, No. 2, 68-73(1957). (Translated from Referat. Zhur. Fiz. No. 6, 1959, abstract No. 12261).

An instrument that makes it possible to analyze molecular beams of any composition is described. The probability of ionization in the source is very high and exceeds substantially the previously attained values. The magnetic-analyzer principle employed insures sufficient resolution (~170) with an insignificant loss of ions and requires only a small amount of magnetic excitation. A portion of the mass spectrum can be made available for visual observation of a short-period change in the composition of the atomic beam. The instrument has great sensitivity and can register partial pressures down to 10^{-12} mm mercury.

23096
THE APPLICATION OF MASS SPECTROMETERS WITH INHOMOGENEOUS MAGNETIC FIELDS FOR GAS ANALYSIS. N. E. Alekseevskii, A. V. Dubrovin, and G. E. Karstens (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Fiz. Khim. 34, 1275-9(1960) June. (In Russian)

It was shown that the use of mass spectrometers with inhomogeneous magnetic fields extends the potentialities of gas analysis. A method is described for determining the gaseous contamination of pure materials. It was found that in some cases the materials contain considerably more gaseous impurities than any other impurities. (auth)

23097
LOW TEMPERATURE BUBBLE CHAMBERS. N. C. Barford (Imperial Coll. of Science and Tech., London). p.87-119 of "Progress in Cryogenics. Volume 2." K. Mendelssohn, ed. New York, Academic Press Inc., 1960.

The discussion is based mostly on the use of liquid hydrogen, partly because most work is done with hydrogen and partly because the same principles that apply to liquid hydrogen chambers apply to liquid deuterium and helium chambers. The differences in the systems are pointed out. Hydrogen provides the simplest target with which to observe nuclear phenomena, but deuterium and helium are of as great an importance. The discussion includes track formation, temperature control, expansion systems, and optical systems. (B.O.G.)

23098
PERFORMANCE OF A PISTON-EXPANDED BUBBLE CHAMBER. J. E. Jensen (Brookhaven National Lab., Upton, N. Y.). p.418-25 of "Advances in Cryogenic Engineering. Volume 4. Proceedings of the 1958 Cryogenic Engineering Conference, Massachusetts Institute of Technology, Cambridge, Massachusetts, September 3-5, 1958." K. D. Timmerhaus, ed. A Cryogenic Engineering Conference Publication. New York, Plenum Press, Inc., 1960.

The tests were initiated to obtain information on the operating range and conditions of a liquid expanded hydrogen bubble chamber. The most pressing question investigated was the feasibility of using deuterium as the track sensitive medium and hydrogen as the refrigerant. Of particular interest were the expanded pressure, the pressure range sensitivity, the time sensitivity, and the effects of temperature and repeated expansions on refrigerant consumption. Using hydrogen as a track medium at 25.3° to 28.9°K, the lowest temperature that tracks were found was 26.1°K. Above that temperature, tracks were found at each test point. For deuterium as a track medium, tracks were found at 30.75° to 32.6°K. The 32.6°K temperature was the limit imposed by the instruments and the refrigeration method used because of the approach to the critical point of hydrogen. Information from these tests will affect the design of future large bubble chambers, will be of immediate use in the field of bubble chambers, and will increase the store of information on the properties of liquid hydrogen and deuterium. (B.O.G.)

23099
CRYOGENIC EXPERIENCE WITH THE 72-INCH BUBBLE CHAMBER. H. P. Hernandez (Univ. of California, Berkeley). p.38-48 of "Advances in Cryogenic Engineering. Volume 5. Proceedings of the 1959 Cryogenic Engineering Conference, University of California, Berkeley, California, September 2-4, 1959." K. D. Timmerhaus, ed. A Cyrogenic Engineering Conference Publication. New York, Plenum Press, Inc., 1960.

A description is given of a 72-in. bubble chamber which is operating in a beam of antiprotons and π^--mesons with 521 liters of liquid hydrogen at pressures to 6 atm. By quickly reducing pressure (18 msec) to 3 atm, the chamber is made sensitive for about 10 msec, during which time the beam particles enter the chamber and cause nuclear interactions. The permeability of the chamber casting must remain below 1.05 at room temperature and 20°K to reduce distortions in the magnetic field. (B.O.G.)

Materials Testing

23100 ER-10911-2
Martin Co., Baltimore.
EVALUATION OF ULTRA-SONIC TEST DEVICES FOR INSPECTION OF ADHESIVE BONDS. Quarterly Progress Report No. 2 for October 1, 1959 through December 31, 1959. John P. Reese, Von H. Boruff, and H. L. Parent. 25p. Contract NOas 59-6266-c.

Four ultrasonic test instruments exhibited capabilities of distinguishing between a solid bond and a complete void by successful inspection of metal-to-metal sandwich panels. The calibration and limiting features of each instrument are discussed. (C.J.G.)

23101 KAPL-2000-10(p.F.5-F.12)
Knolls Atomic Power Lab., Schenectady, N. Y.
BENDING STRESSES IN A PRESSURE VESSEL WITH AN INTEGRAL FLAT HEAD. L. Deagle.

Data are presented which were prepared to facilitate the design of thin-walled cylindrical pressure vessels with integral flat heads. Formulas and curves are given for the maximum bending stresses in the head and in the cylindrical shell. The equations derived are based on the solutions to the differential equations for thin plates and shells as given by Timoshenko. (W.D.M.)

23102 STI/DOC/10
International Atomic Energy Agency, Vienna.
REVIEW OF RESEARCH ON NON-DESTRUCTIVE ANALYSIS OF REACTOR FUEL ELEMENTS. A study by S. L. Ruby and D. G. Gardner (Westinghouse Electric Corp., Atomic Power Dept.). 1959. 41p.

A selected bibliography is presented on the nondestructive assay of irradiated and unirradiated reactor fuel assemblies. The bibliography also includes a discussion and evaluation of these papers in the light of the problems presented by variations in enrichment, alloying, cladding, geometrical arrangement, etc., among the many kinds of fuel assemblies. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

23103 A/AC.82/R.86(Add.1)
United Nations. Secretariat.
ENVIRONMENTAL CONTAMINATION FROM TESTS OF NUCLEAR WEAPONS. Some data on Strontium^{90} fall-out in the years 1958–1959. Dec. 28, 1959. 11p.

Graphical and tabular summaries of fall-out data on Sr^{90} for the years 1958 and 1959 were prepared. Age vs. time for fall-out radioactivity and amount of Sr^{90} deposited vs. time were measured at several points around the globe. The latitudinal distribution of fall-out was determined. Fall-out data for New York City; Nagasaki, Japan; Durban, Union of South Africa; and Vienna, Austria were summarized. The change in the amount of Sr^{90} produced as a function of assumed half life was calculated and a stratospheric inventory of Sr^{90} was made. (M.C.G.)

23104 HW-54286
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
METEOROLOGICAL FACTORS IN THE CONTROL OF SHORT-PERIOD, GROUND LEVEL CONCENTRATIONS OF SEPARATIONS STACK EFFLUENT. James J. Fuquay. Dec. 27, 1957. Decl. June 10, 1960. 35p. Contract W-31-109-Eng-52. OTS.

A method is developed for use in the analysis and meteorological control of atmospheric pollution problems resulting from gaseous emissions from tall stacks. Special attention is given to the dilution of the gas within the stack due to the addition of excess air. Control parameters are developed for cases in which short periods of high concentration are important, as contrasted to long-period average concentrations. Application of the method is demonstrated with a sample calculation for the oxides of nitrogen emitted from a process stack. (auth)

23105 TID-6309
Division of Biology and Medicine, AEC.
OCEANOGRAPHY IN THE ATOMIC ENERGY COMMISSION. I. E. Wallen. [1959]. 17p. OTS.

The Atomic Energy Commission has a limited research program in oceanography and marine biology. The program includes specialized basic problems such as deep ocean currents as a distributive mechanism for radioactivity, dispersal and distribution of fall-out radionuclides through the ocean layers, food web concentration of radioactive isotopes in ocean waters, and mechanisms for reduction or dilution of possible centers of radioactivity in the ocean. (W.L.H.)

23106 TID-8207
Office of Operations Analysis and Forecasting, AEC and Division of Raw Materials, AEC.
ENERGY FROM URANIUM AND COAL RESERVES. Robert D. Nininger, Conrad I. Gardner, Milton F. Searl, and Donald W. Kuhn. May 1960. 11p. OTS.

Tables of estimates are presented of domestic and world uranium reserves and resources. Tables are also given that show estimated coal reserves recoverable at various price levels for the U. S., the Free World, and the entire world. Calculations were made of the heat energy available from the estimated uranium and coal reserves. The data are included. (W.L.H.)

23107 AEC-tr-4067
URANIUM IN CAMBRIAN ALUM SHALES IN THE OSLO REGION AND ADJACENT DISTRICTS. (Uran i Kambrisk Alumskifer i Oslofeltet og Tilgrensende Områder). Steinar Skjeseth. Translated from Norg. Geol. Undersökelse No. 203, 100-11(1957). 12p. JCL.

Investigations of the black Alum shales in the Oslo Region initiated the systematical prospecting for uranium in Norway. The Alum shales is a black shale formation in the Cambrian system in southern Norway. The outcrops of Alum shales in different districts within the Oslo Region are shown on the map and the stratigraphy of the formation. In the south, the Cambrian shales lie flat on the Precambrian. Towards north it is an increasing folding and faulting. Field investigations were carried out by Land-Rover with mounted Geiger-Mueller counter. For detailed investigations and sampling Geiger-Mueller and Scintillation counters were used. The Upper Cambrian zones 2c to 2d have the highest radioactivity in the whole Oslo Region. The content of uranium in these zones is 50 to 100 g/ton with maximum 170 g/ton in thin layers. (auth)

23108 JPRS-5049
THE ISOTHERMAL DISPERSION OF A GAS CLOUD. V. S. Imshennik. Translated from Doklady Akad. Nauk S.S.S.R. 131, 1287-90(1960). 10p. OTS.

A mathematical analysis is presented which leads to the conclusion that in the isothermal case, there exists an asymptotic solution for gas cloud dispersion. The forces of mutual attraction and the magnetic field are not considered. (J.R.D.)

23109 NP-tr-467
AVAILABILITY, PRODUCTION AND CONSUMPTION OF URANIUM. F. Ippolito. Translated by S. Fitzgerald (U.K.A.E.A. Atomic Energy Research Establishment) from Ind. mineraria (Rome) 10, (1959) Sept. 10p. (CNG-34). JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 2678.

23110

RADIOACTIVITY OF BATHOLITHE OF ELBEMA (HOGGAR). R. Coulomb (Commissariat à l'Énergie Atomique, Saclay, France). Bull. soc. franç. minéral. et crist. 81, 227-31(1958). (In French)

The distribution of uranium, potassium, and α and γ radioactivity of a granite massif in the Hoggar, Sahara was examined. Statistical application of results show the existence of a close relationship between activity fluctuations and uranium content variations. There is, on the other hand, no clear correlation between activity and K_2O content. (auth)

23111

CONCENTRATION OF PARTICULATE AIR-BORNE FISSION PRODUCTS AT GROUND LEVEL IN CANADA DURING I.G.Y. J. L. Wolfson and F. Terentiuk (National Research Council, Ottawa). Can. J. Phys. 38, 991-1010(1960) Aug.

Daily measurements are reported of the concentration of air-borne fission products at ground level in Canada during the period from late 1957 to the end of March 1959. The measurements, conducted at 14 stations throughout Canada, were part of the Canadian program for the International Geophysical Year and International Geophysical Cooperation. The results are given in the form of charts for each of the 14 stations, and monthly averages for each of the stations are tabulated. (auth)

23112

THE CONCENTRATION OF URANIUM IN THE WATERS OF THE BLACK SEA. D. S. Nikolaev, O. P. Koron, K. F. Lazarev, L. B. Kolyadin, Yu. V. Kuznetsov, and S. M. Grashchenko. Doklady Akad. Nauk S.S.S.R. 132, 1411-12 (1960) July 21. (In Russian)

Detailed data were obtained during the summer of 1958 on the concentrations of uranium in the central and western sections of the Black Sea. The luminescence tests made with 0.3 to 1 liter specimens of water showed uranium concentrations from 1.5×10^{-6} to 2.8×10^{-6} g/liter. The order of accuracy is about ±20%. The mean concentration for the analyzed sections is $(2.0 \pm 0.3) \times 10^{-6}$ g/liter. It is also found that the incoming rivers reduce the mineralization of the marine water but do not alter the uranium concentrations. (R.V.J.)

23113

DISPERSAL OF RADIOACTIVE EMANATION IN LOWER ATMOSPHERE. L. S. Grandin and R. E. Soloveichik (Leningrad Mining Inst.). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. 7, 1077-81(1960) July. (In Russian)

An analysis is made of the dispersal of radioactivity during turbulent diffusion in the vertical direction induced by winds and radioactive decay. The wind velocity and direction are taken as constant. (R.V.J.)

23114

ISOTOPIC COMPOSITION AND TEMPERATURE OF FORMATION OF ANTARCTIC SNOWS. E. Picciotto (Université, Brussels), X. de Maere, and I. Friedman. Nature 187, 857-9(1960) Sept. 3.

The isotopic composition of snows was studied in relation to seasonal variations and temperatures of formation for samples collected in 1958 at the Belgian Antarctic Base. The temperatures of snow formation were determined from aerological radio soundings, and the D : H and $O^{18} : O^{16}$ ratios were expressed as Δ(% with respect to standard mean ocean water) and ∂(0/00), respectively. The plotted results show that Δ is maximum in winter (Nov. to Apr.) and minimum in summer (May to Oct.) and give the following relations: $\partial = -(0.9T + 6.4)$, $\Delta = -(0.8T + 8)$, and $\partial = 0.8\Delta + 1.8$, when T is in °C. A variation of 1°C gives a relative variation of 1 0/00 in ∂ and 0.8% in Δ. ∂ and Δ appear to be independent of conditions other than T, e.g., cloud height and type of precipitation. Drift-snow samples were excluded. (D.L.C.)

23115

RADIOACTIVE CONTAMINATION IN THE UPPER ATMOSPHERE. C. Ishii (Meteorological Research Inst., Tokyo). Papers Meteorol. and Geophys. (Tokyo) 11, No. 1, 6p.(1960). (In English)

Although numerous measurements have been made on the radioactive contamination near sea level, knowledge of the contamination in the upper atmosphere is still very imperfect. "Radioactivity-sonde," which is the combination of balloon-borne instrument and telemetering technics, was utilized for upper atmosphere radioactivity measurements. Measurements were made 18 times from 1957 to 1959 at the Aerological Observatory, Tateno, about 50 km northeast of Tokyo (36°03′N 140°08′E). (auth)

23116

BEHAVIOR OF RADIOACTIVE FALLOUT AND AIR-MASSES AROUND JAPAN. R. Koike (Japan Meteorological Agency, Tokyo). Papers Meteorol. and Geophys. (Tokyo) 11, No. 1, 5p.(1960). (In English)

By analyzing the air masses covering Japan, the origin and the movement of radioactive fall-out were determined. The fall-outs originating at Bikini and in the Arctics were transported with the Ogasawara air mass and the Siberia air mass, respectively. The fall-out in Southwest Siberia was transported from the north with the Siberia air mass or from the west with the strong westerlies. The fall-out discharged in the troposphere spreads over a large area in the atmosphere after about three months travel from its original site. (auth)

23117

RADIOACTIVITY OF AIR-BORNE DUSTS AND ATMOSPHERIC PRESSURE PATTERNS. R. Koike and N. Murayama (Japan Meteorological Agency, Tokyo). Papers Meteorol. and Geophys. (Tokyo) 11, No. 1, 3p.(1960). (In English)

Statistics indicate that the radioactive dusts near the ground surface depend on the surface air pressure pattern. The concentration of radioactive dusts in the air is higher in an anticyclonic area than in a low pressure area. Radioactive dust concentrations are also affected by the surface air current. They are higher in regions where the air stagnates. (auth)

23118

Sr-90 DEPOSITION AND METEOROLOGICAL FACTORS. S. Ohta (Japan Meteorological Agency, Tokyo). Papers Meteorol. and Geophys. (Tokyo) 11, No. 1, 6p.(1960). (In English)

Sr^{90} deposition dependence on rainfall, season, and geographical location was investigated by the coaxial method using the data from six stations in Japan during 1958. It was found that although Sr^{90} deposition increased with rainfall, the rate of increase varied widely with season and that local variation was not so large. The relation of the concentration of Sr^{90} in rain to the amount of rainfall was then obtained from measured and estimated values. The results showed that the Sr^{90} content in rain varied with rainfall, and where the rainfall was small there was a tendency of the concentration to increase with rainfall. It appeared necessary to take this into account when problems such as the seasonal variation of Sr^{90} concentration in rain were considered. Almost similar results are obtained with the data for the same period in the U. K. (auth)

23119

RADIOACTIVE FALLOUT IN JAPAN AND ITS BEARINGS ON METEOROLOGICAL CONDITIONS. Y. Mikyake, K. Saruhashi, Y. Katsuragi, and T. Kanazawa (Meteorological Research Inst., Tokyo). Papers Meteorol. and Geophys. (Tokyo) 11, No. 1, 8p.(1960). (In English)

The relation between radioactive fall-out and meteorological conditions was studied. The relation of rainfall amount to fall-out (R) can be expressed fairly well by the formula $R = C(1 - e^{-\beta P} + \kappa P)$, where P is the amount of rainfall, C is the air activity, β and κ are constants. There is little correlation between the surface weather conditions and fall-out while a considerably higher correlation was found among a trough at 500 mb, position of jet stream, and air activity. The activity increases remarkably when a trough at 500 mb passes above and a core of the jet stream is located above or a little south of an observation point. The analytical results of studies of Sr^{90} deposition in Japan since 1954 and its seasonal variation are also discussed. (auth)

23120

CARBON-14 DATING WITH THE LIQUID SCINTILLATION COUNTER: TOTAL SYNTHESIS OF THE BENZENE SOLVENT. Murry A. Tamers (Univ. of Texas, Austin). Science 132, 668-9(1960) Sept. 9.

Samples were analyzed for natural radiocarbon content by a total synthesis of benzene from their organic constituents. The benzene was employed as the solvent in a liquid scintillation counter. The instrument used permitted 15 grams of carbon to be counted with an efficiency of 40% and a background of 13 count/minute. (auth)

23121

Geological Survey, Washington, D. C.

CHEMICAL COMPOSITION AS A GUIDE TO THE SIZE OF SANDSTONE-TYPE URANIUM DEPOSITS IN THE MORRISON FORMATION ON THE COLORADO PLATEAU. A. T. Miesch, E. M. Shoemaker, W. L. Newman, and W. I. Finch. Geological Survey Bulletin 1112-B. 1960. 49p. $0.25 (GPO).

The concentrations of uranium, yttrium, sodium, iron, zirconium, manganese, calcium, and nickel in 75 mill-pulp samples of uranium deposits in the Salt Wash member of the Morrison formation on the Colorado Plateau have been found by statistical tests to be significantly related to the size of the deposits represented by the samples. The elements mentioned above are related to the formation of the deposits in a variety of ways. Zirconium is an intrinsic element, contained principally in the detrital syngenetic fraction of the host sandstone. Calcium, manganese, and sodium are intrinsic elements, contained principally in epigenetic (diagenetic) carbonate in the host sandstone. Uranium, yttrium, and nickel are principally extrinsic elements, introduced into the host sandstone by uranium mineralization or related processes. Somewhat more than half of the iron is probably intrinsic and the remainder is extrinsic. Three methods can be used to estimate the size of uranium deposits in the Salt Wash member within broad limits. Method 1 is based on simple linear-regression theory; method 2 is based on multiple-regression theory (long method); and method 3 is based on multiple-regression theory (short method). For methods 1 and 2 the estimated log size of each deposit can be computed from tables showing the known concentration of uranium, yttrium, sodium, iron, zirconium, manganese, calcium, and nickel in the deposits, as determined by semiquantitative spectrographic analysis. For method 3 the estimated size or log size can be read directly from a table showing known concentration of uranium and yttrium only. About 80 % of the tonnage-size estimates from method 1 will be within a factor of 13 (12−14) of the true sizes. The precision of the size estimates from method 2, the long multiple-regression method, is highly variable. Some estimates from method 2 will be within a factor of 12 of the true size at the 80-% confidence level; others, will be within a factor of 40 at the 80-% confidence level. About 80 % of the tonnage-size estimates from method 3, the short multiple-regression method, will be within a factor of 15 (13−16) of the true size. A group of 40 deposits of known size was used to test the theoretical derivation of the confidence intervals given above. It was concluded from the test that the confidence intervals describe the precision of the methods correctly. The methods for estimating the size of uranium deposits are useful where the ore is poorly exposed or where an independent estimate is desired. The error of the estimates may be quite large, as indicated by the confidence limits given above; but the estimates can be used to distinguish very large from very small deposits. They also may serve to encourage or discourage further expenditures in the development and exploration of ore bodies. The methods of size estimation can be particularly useful in attempts to appraise or compare groups of deposits or mining districts, inasmuch as the average estimate of size of deposits in a group is more precise than any single estimate. The methods for estimating size are established only for deposits in the Salt Wash member of the Morrison formation. Tests indicate that the equations calculated for deposits in the Salt Wash fail completely if applied to deposits in other stratigraphic units such as the Moss Back and Shinarump members of the Chinle formation. A further restriction, not completely evaluated at present, is that semiquantitative spectrographic analyses of mill-pulp samples are required. No tests have been made to determine the precision and accuracy of the methods when other types of samples, such as drill core, are used. (auth)

23122

Geological Survey, Washington, D. C.

THE DEVELOPMENT OF BOTANICAL METHODS OF PROSPECTING FOR URANIUM ON THE COLORADO PLATEAU. Helen L. Cannon. Geological Survey Bulletin 1085-A. 1960. 54p., 2 illus. GPO.

Botanical methods of prospecting for uranium on the Colorado Plateau have been developed by the U. S. Geological Survey. Detailed investigation has shown that a relation exists between the distribution of mineralized ground and of specific herbaceous plants. The distribution of these plants is controlled by the presence of selenium, sulfur, and other trace elements available in the environment of the uranium deposit. Investigation also has shown that the uranium content of trees rooted in ore is significantly higher than that of trees rooted in barren ground. On the flat-lying sediments at lower altitudes of the Colorado Plateau there is a definite correlation between major plant zones and stratigraphic units. Chemical differences that occur in a mineralized area within a formation produce, on the other hand, recognizable changes in the plant societies, which may be useful as indicators in prospecting. Information concerning the availability of ions in an ore environment and the absorption of these ions by plant species is important in the development of botanical prospecting techniques. Plants that act as indicators of uranium ore on the Colorado Plateau are controlled by the increased availability of selenium, sulfur, calcium, or phosphorus in the vicinity of ore deposits. The most useful plant species is Astragalus pattersoni; the distribution of this plant has led to the discovery of ore deposits in several districts. Prospecting by mapping the distribution of indicator plants is most effective at altitudes below about 7,000 feet where the ore horizon is less than 40 feet below the surface and where the ore contains 0.001 % or more selenium. Plants of the mustard family excel in the absorption of uranium but are not as useful in prospecting by plant analysis as coniferous species of deep-root habit and wide distribution. The average uranium content of coniferous trees growing in barren areas is 0.5 ppm compared to 1.5 ppm in mineralized ground. Tree samples may be collected on a grid pattern, analyzed for uranium content by a recently devised chromatographic field test or the older fluorimetric laboratory method, and the values contoured to indicate mineralized ground. The method is applicable in areas of thick forest cover where the ore horizon is at a depth of 70 feet. Botanical methods of prospecting have been studied and evaluated in 10 districts of the Colorado Plateau. Nearly 11,000 tree samples have been analyzed for uranium, and indicator plants have been mapped along 50 miles of outcrop. Both methods are useful in delineating the extent of mineralized ground. A number of ore bodies were found during the period of appraisal. (auth)

23123
LEAD ISOTOPES IN GEOLOGY. R. D. Russell and R. M. Farquhar. New York, Interscience Publishers, Inc., 1960. 248p. $9.00.

A discussion is presented of the interpretation of lead isotope abundances and applications in geology. The views expressed are mainly those of the authors, but references are made to the results and interpretations of other scientists. The monograph is concerned with the isotopes of common lead, and although the dating of U and Th minerals was mentioned, this aspect of lead isotopes was not developed in detail. Included are a number of tables of useful functions which were found to be invaluable in carrying out calculations for measured Pb isotope ratios. (B.O.G.)

HEALTH AND SAFETY

23124 A/AC.82/G/L.348
Heidelberg, Germany. Universität. Zweites Physikalisches Institut.
ESTIMATE OF FUTURE Sr^{90}–DEPOSITION. G. Schumann. Feb. 2, 1960. 4p.

The maximum deposition of Sr^{90} and the actual date of its occurrence, in the event of no further nuclear tests, were calculated as a function of stratospheric storage time. The degree of saturation of deposition, in the event of continued nuclear testing, was calculated assuming a constant production of fission products equal to that of 1958. (M.C.G.)

23125 A/AC.82/G/R.141 and Add. 1
Tokyo Univ.
RADIOLOGICAL DATA IN JAPAN. II. CONCENTRATIONS OF Sr^{90}, Cs^{137}, Pu^{239}, AND OTHERS IN VARIOUS MATERIALS ON EARTH'S SURFACE. Yoshio Hiyama, comp. Nov. 20, 1957. Addendum 1. Feb. 13, 1958. 24p.

Concentrations of Sr^{90}, Cs^{137}, Pu^{239}, Zn^{65}, Fe^{55}, and Cd^{113} in various Japanese media and locations are tabulated. Discussion and explanations of data are included. (J.R.D.)

23126 A/AC.82/G/R.157
Argentina. Comisión Nacional de Energia Atómica. Laboratorio de Medición de la Precipitation Radiactiva Atmosferica, Buenos Aires.
LA PRECIPITACION RADIACTIVA ATMOSFERICA EN LA REPUBLICA ARGENTINA DURANTE EL AÑO 1957. (The Atmospheric Radioactive Precipitation in the Argentine Republic during the Year 1957). N. Nussis, C. Henkel, and M. Menis. December 1957. 18p.

The results of the measurement of the radioactive fallout in the Argentine Republic in 1957 are tabulated. The chemical and radiometric methods used for the analysis of the samples collected are given. The results showed two peaks in the activity which correspond approximately to the last quarter of 1956 and the second and third quarter of 1957. (J.S.R.)

23127 A/AC.82/G/R.219
Copenhagen. Universitet.
GONAD-DOSE-MEASUREMENTS IN DENMARK. E. Hammer-Jacobsen. Apr. 14, 1958. 23p.

Results are reported from a survey of the radiation dose to the gonads received by patients during intravenous pyelography in hospitals in Denmark. (C.H.)

23128 A/AC.82/G/R.229
Československá Akademie Veď. Biofyzikdlne Ústav, Brno.
MEASUREMENTS OF RADIOACTIVE FALL-OUT ON THE TERRITORY OF THE CZECHOSLOVAK REPUBLIC. Vladimír Kleinwachter and Vladimír Drášil. Sept. 25, 1958. 7p.

Data are tabulated on the amount of radioactive fallout in samples collected at nine stations in Czechoslovakia during 1956 and 1957. (C.H.)

23129 A/AC.82/G/R.237
Germany. Bundesministerium für Atomkernenergie und Wasserwirtschaft.
TABLES OF RADIOLOGICAL DATA. May 30, 1958. 36p.

Radiological data obtained in the Federal Republic of Germany are summarized in tables. The RBE dose rate in the skeleton and gonads due to natural and artificial sources was determined in mrem/yr for both internal and external radiation. Demographic data were summarized in two tables. Information was collected on cosmic rays, total external natural background radiation, and internal radiation due to K^{40}, C^{14}, and inhalation of decay products of radon in the air. Data on diagnostic x-ray examinations and occupationally-exposed individuals were collected and the genetically-significant dose rate calculated. The external irradiation due to fallout, the irradiation due to radium in the skeleton, irradiation from miscellaneous sources, and the cumulative depositions of Sr^{90} and Cs^{137} were measured. (M.C.G.)

23130 A/AC.82/R.77
United Nations. Secretariat.
PRELIMINARY REPORT ON RADIOCARBON FROM NUCLEAR TESTS. Dec. 7, 1959. 17p.

The production of C^{14} by nuclear tests and its present and future distributions throughout the carbon cycle in nature were studied. The time and latitudinal distributions were calculated. The radiation dose due to naturally occurring C^{14} and that produced in nuclear tests were also calculated. The best estimate of the total amount of C^{14} produced by the tests was 25×10^{27} atoms, which would deliver a radiation dose to the tissue of 8 mrad over the next 30 years and 114 mrad over the lifetime of C^{14}. The genetic effects of the rate of delivery and duration of the dose and the special consequences of the transmutation effect within important molecules were considered. (M.C.G.)

23131 A/AC.82/R.81
United Nations. Scientific Committee on the Effects of Atomic Radiation.
A SURVEY OF INFORMATION ON METEOROLOGICAL ASPECTS OF WORLD-WIDE FALLOUT. L. Machta. Dec. 14, 1959. 48p.

Information on the physical aspects of world-wide radioactive fall-out was reviewed in order to develop a set of principles from which a prediction of fall-out from past or future atomic tests could be made. The review was limited to the history of weapon test radioactivity from the time of formation to the time of permanent deposition on the earth.

The fate of long-lived products was emphasized. Fractionation, characteristics of particulate fission products, and chemical properties of the products were investigated. The distributions in soils, rainfall, oceanic materials, snow, ground level air, upper troposphere, and stratosphere were observed. The total amount of fission products created through 1958 was calculated. The transport of radioactive clouds in the troposphere, movement in the stratosphere, and residence times were investigated. The distribution of future fall-out was estimated. (M.C.G.)

23132 A/AC.82/R.86
United Nations. Scientific Committee on the Effects of Atomic Radiation.
ENVIRONMENTAL CONTAMINATION FROM TESTS OF NUCLEAR WEAPONS. Dec. 28, 1959. 82p.

Environmental contamination from tests of nuclear weapons was investigated. A general review was made of the amount and distribution of fission products observed from stratospheric fall-out, ground deposit, and soil content. The distribution of Sr^{90} was given special study. Information was collected on the mechanisms of the formation and physico-chemical properties of radioactive aerosols including radioactive cloud formation and nitric acid formation. The rate of diffusion, stratospheric residence time, and cloud volume were studied. Observations were made of the stratosphere reservoir of strontium-90. (M.C.G.)

23133 AD-236714
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A STUDY OF NEUTRON ACTIVATION OF BODY ELEMENTS (thesis). Perry Lee Stephens. Mar. 1960. 73p.

A phantom designed to simulate Air Force flying personnel is described which is made up of parts approximating the size and shape of corresponding human body parts. From data on the chemical composition of the human body, the mean concentration of each body element and selected isotopes of these elements was determined for each part of the phantom. The whole-body activity produced by neutron activation of specific body isotopes is determined for various fluxes of incident neutrons by using the phantom for mathematical calculation. Graphs are included from which the incident neutron flux can be determined after the gamma radiation emitted by the activated body is measured. A brief discussion of whole-body counters and their use in measuring body gamma radiation is presented. An example is included to illustrate use of the graphs. (auth)

23134 AEET/AM/10
India. Atomic Energy Establishment, Trombay.
STRONTIUM-90 IN MILK AND HUMAN BONE IN INDIA. K. G. Vohra, C. W. Joshi, S. B. Hingorani, and B. Y. Lalit. Nov. 24, 1959. 9p.

Data are summarized on the levels of strontium-90 in samples of milk and human bone collected in India since early in 1958. The sampling, analytical, and radiometric procedures used are described. (C.H.)

23135 BIO-51-58
Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.
DATA ON RADIOACTIVE FALL-OUT, COLLECTED IN ITALY (JANUARY–JUNE 1958). Oct. 25, 1958. 13p. (A/AC.82/G/R.238).

Data on radioactive fall-out were collected in Italy at Savona, Livorno, Siena, Camerino, Pisa, Rome, Cagliari, Messina, Monte Cimone, Bologna, and Verese. The mean concentrations of fission products in the air at ground level were measured from January to June, 1958 at most of these locations. The deposition of fission products by rain was also measured each month and the number of days with precipitation was recorded. (M.C.G.)

23136 CNC-35
Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.
MISURA DELLA RADIOATTIVITA BETA TOTALE DELL'ARIA, FALL-OUT E ACQUE GEOGRAFICHE ESEGUITE AL C.S.N. DELLA CASACCIA. (Measurements of the Total Beta Radioactivity of Air, Fall-out and Geographical Waters Made at the C.S.N.–Casaccia). S. Tagliati. June 1960. 24p.

Methods for collecting and treating fall-out and water samples and techniques for measuring the total beta activity of residues, used at the C.S.N.–Casaccia, are described. Attention is drawn to the convenience of adopting a new unit more consistent with the actual behavior of the radioactivity in the case of the water. The hystograms of the total beta activity of the air, fall-out, and water are reported for the period October 1959 to February 1960. (auth)

23137 CNHW(RP-3)
Canada. Dept. of National Health and Welfare. Radiation Protection Div., Ottawa.
ANNUAL REPORT FOR 1959 ON THE RADIOACTIVE FALLOUT STUDY PROGRAM. P. M. Bird, A. H. Booth, and P. G. Mar. May 1960. 78p.

The average monthly fission product activity in daily ground-level air samples collected at 24 meteorological stations in Canada was found to decrease from about 0.85 dpm/m^3 in August 1959 to about 0.3 dpm/m^3 by the end of the year. The average monthly fission product activity in precipitation samples collected at 9 sampling stations was found to increase from about 25 mc/mi^2 in January, 1959 to about 65 mc/mi^2 in April, 1959. Subsequently, the average monthly fission product activity in precipitation samples collected at 24 meteorological stations was found to decrease to about 5 mc/mi^2 in December, 1959. The average Sr^{90} content of milk powder samples collected at 16 milk powdering plants during 1959 was found to increase from about 11 micro micro curies per gram calcium in January to about 21 in June. The level then decreased to about 12 in September before increasing again to about 15 micro micro curies per gram calcium in December. The Sr^{90} content of human bone samples collected from 97 subjects during 1957 and 1958 ranged from 0.36 to 5.9 micro micro curies per gram of calcium for children and from 0.07 to 0.82 micro micro curies per gram of calcium for adults. (auth)

23138 CRER-906
Atomic Energy of Canada Ltd., Chalk River, Ont.
A COMPARISON OF AN OPEN POT COLLECTOR WITH THE ION EXCHANGE FALLOUT COLLECTOR. J. E. Guthrie. June 1960. 12p. (AECL-1036). AECL.

A study of rainfall samples collected by open pot and ion exchange fallout collectors is described. The aim of the study was to compare these collection methods in regard to ease of handling, total beta and gamma activity collected, and effort required for sample preparation prior to counting. It was concluded that the methods are about equally efficient. (J.R.D.)

23139 DASA-1180
Walter Reed Army Medical Center. Inst. of Research, Washington, D. C.
THE DETERMINATION OF INTERNALLY DEPOSITED RADIOACTIVE ISOTOPES IN THE MARSHALLESE PEOPLE BY EXCRETION ANALYSIS. Kent T. Woodward, Ariel G. Schrodt, James E. Anderson, Harry A. Claypool, and James B. Hartgering. [1959?] 19p. OTS.

Following the detonation of a thermonuclear device at the

Pacific Test Site on Mar. 1, 1954, 239 Marshallese people were exposed to significant levels of gamma radiation from fall-out. During the two-day fall-out exposure before evacuation to Kwajalein these people also received internal doses of radioactive materials. Estimates of the internal body burden from fallout were obtained from analysis of urine samples collected soon after exposure and at intervals through 1958. Data on Cs^{137}, Sr^{90}, and Zn^{65} body burden and excretion are tabulated and discussed. (J.R.D.)

23140 KAPL-M-HP-5
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL–JUNE 1960. R. J. Feinberg, comp. 25p. Contract W-31-109-Eng-52. OTS.

Health physics activities during the period are summarized, including routine radiation monitoring services. Emergency monitoring services were provided when a fire occurred in the main duct of a high-velocity exhaust system. Investigations were conducted to determine the cause of the unexpected radiation dose rate measured in a filter serving the RNL chemistry cell. Copies of the environmental monitoring reports were prepared for issuance to the general public. The quarterly audit of external and internal radiation exposure revealed no personnel exposure greater than the maximum permissible limits set by the National Committee on Radiation Protection and Measurements. Approximately 26 mc of fission product radioactivity were released to the atmosphere and 430 mc were discharged into the Mohawk River. Experiments were conducted to accurately calibrate the water-moderated sigma pile substitute for thermal neutron fluxes from a 10c Pu–Be neutron source. (M.C.G.)

23141 NRL-5440
Naval Research Lab., Washington, D. C.
CRITICAL ANALYSIS OF MEASUREMENTS OF THE GROSS FISSION PRODUCT ACTIVITY IN THE AIR AT GROUND LEVEL. L. B. Lockhart, Jr. and R. L. Patterson, Jr. Nov. 18, 1959. 19p. Project No. NR 571-000. (A/AC.82/G/L.359).

A comparison of the fission product radioactivity in the air at a given site as determined by use of different techniques for collection of samples and measurement of radioactivity has shown widely divergent results were obtained. A study of the two widely different techniques in use at NRL has demonstrated that these discrepancies are due to the different counting and standardization techniques employed and to the inherent difficulty resulting from the changing β spectrum of fission products with age. The procedures employed for estimation of the radioactivity of samples collected in the NRL 80th-meridian program seem to be relatively insensitive to this changing β energy and to give particularly good results for the older debris. For the most accurate results the radioactivity of some one or more specific isotopes should be followed. (auth)

23142 ORNL-2359
Oak Ridge National Lab., Tenn.
METAL RECOVERY PLANT RADIATION REPORT FOR JANUARY–MARCH 1957. C. D. Hylton. Oct. 9, 1957. Decl. May 4, 1960. 8p. Contract W-7405-eng-26. OTS.

During the quarter 19 persons worked in the Metal Recovery Plant. The total radiation exposure received by this group was 21.6 rep, an average of 87 mrep/man-week. The exposure per person ranged from 10 to 63 % of the permissible (3.0 rep/quarter). The γ-activity level of the feeds was 10^6, 10^7, and 10^5 counts/min/ml, respectively. The processing equipment was cleaned and decontaminated prior to processing. (auth)

23143 SC-4225(M)
Sandia Corp., Albuquerque, N. Mex.
GENERAL INSTRUCTIONS FOR THE RECOVERY OF RADIOACTIVE CONTAMINATED EQUIPMENT. [Aug. 1960]. 20p. Contract [AT(29-1)-789]. OTS.

Essentials of planning and action necessary for the recovery of radioactive contaminated equipment following a radiological disaster are outlined. The records which should be collected before a disaster are listed and the training of personnel for recovery teams is discussed. Radiation doses, radiation indicators, and protective clothing are treated in a general fashion. Procedures are given for recovery of equipment, with emphasis on personnel safety followed by discussions of decontamination techniques and materials. Graphs and calculations are presented for determining safe work limits and radiation doses under varied conditions. A list of typical sources for radiological supplies and a brief bibliography are also included. (auth)

23144 TID-6207
General Mills, Inc., Minneapolis.
UPPER ATMOSPHERE MONITORING PROGRAM. Progress Report No. 9 covering period August 1, 1959 through October 31, 1959. Report No. 2039. J. Baumstark, L. Graf, I. Hall, S. Jones, J. H. Nash, R. Olson, S. Stern, L. Torgeson, and W. Zeller. June 1, 1960. 41p. Project 89125. Contract AT(11-1)-401. OTS.

Activities during the present period include testing a new rotor assembly for the focusing array impactor at reduced pressures and continuation of a theoretical study of fibrous filter mats in an effort to establish means for determining particle size and particle size distribution of upper atmosphere radioactive debris. The effect of the NaCl present in an undialyzed S13 bacteriophage suspension on the particle size of the aerosol produced when the suspension is nebulized was determined and development of additional instrumentation for inclusion on balloon flights to allow for greater accuracy in air volume determinations is reported. Data from ten balloon flights conducted during the present period as well as those dating back to December 1958 were analyzed. (For preceding period see AECU-4680.) (auth)

23145 UCRL-5676(p.42-59)
California. Univ., Los Angeles.
FACTORS INFLUENCING THE BIOLOGICAL CONSEQUENCES OF ENVIRONMENTAL CONTAMINATION BY NUCLEAR DEBRIS. R. G. Lindberg.

The physical and chemical properties of fall-out debris are discussed. It is pointed out that the biological consequences of environmental contamination by radioactive debris are largely a function of the physical characteristics of the contaminants and the utilization of the contaminants by plants or animals is dependent upon the material being in a soluble or digestible form. Until this occurs the effect of radioactive debris is limited to the production of an external radiation field of rapidly declining intensity. A review of data on fall-out from previous detonations suggests that whatever the conditions of surface or above-ground detonation may be, a complete spectrum of kinds of fall-out particles are produced but with the proportion of those bearing a specific set of characteristics dependent upon the nature of the detonation. The conditions of detonation, therefore, strongly influence the physical properties of the particles produced. The biological effects of fall-out are largely dependent upon particle size, physical and chemical properties, and the specific radioisotopes that are present.

It is anticipated that in the case of excavation detonations neutron-induced activity may make the most significant contribution to the fall-out field during the acute periods of contamination if significant amounts of radioactive debris should escape during excavation events. The biological problems resulting are probably of a short-term nature. Data are tabulated on isotopic fractionation and fall-out pattern during Operation Plumbbob. In its general characteristics, it is representative of fall-out patterns produced by shallow underground, tower-, or balloon-supported detonations. If venting should occur during excavation activities of the Plowshare Program, it would be expected that escaping radioactive debris would be deposited in a similar pattern. The radiation intensity will depend upon the energy yield, the specific design of the device, the location of the device with regard to the ground surface, and meteorological conditions. Ecological concepts which must be considered in evaluating the biological consequences of radioactive contamination are discussed. (C.H.)

23146 USNRDL-TR-425
Naval Radiological Defense Lab., San Francisco.
A THEORY OF FORMATION OF FALLOUT FROM LAND-SURFACE NUCLEAR DETONATIONS AND DECAY OF THE FISSION PRODUCTS. C. F. Miller. May 27, 1960. 129p.

The current concepts of the formation of fall-out from land-surface nuclear detonations were reviewed. Thermodynamic equations were developed for a part of the overall condensation process to account for fractionation of the radioactive species. Empirical functions for some of the fireball parameters were developed from available data and assumptions about the utilization of the energy released in a nuclear explosion. These functions and available data on the vapor pressure of fission-product elements and compounds (mainly oxides) and on the fission yields from fission of U^{235}, U^{238}, and Pu^{239} were utilized to compute decay curves for the unfractionated mixtures and for an idealized fall-out condition from a surface nuclear detonation. (auth)

23147 USNRDL-TR-429
Naval Radiological Defense Lab., San Francisco.
RADIOLOGICAL SAFETY REPORT, OPERATION STONEMAN II. W. J. Friedman. June 8, 1960. 45p.

The health physics aspects of a field-scale operation involving the dispersal and decontamination of ton quantities of synthetic radioactive fallout are described. Provision of radiological safety services for the operation involved pre-operational planning for logistics and services, a training and indoctrination program for Rad-safe personnel, design, and operation of a change house and personnel decontamination center, a dosimetry program and interpretation of its data, consultation with the project officer on health physics problems, waste disposal, environmental monitoring during pre-operation, operational, and post-operational phases, and radiological monitoring for the operation. The problems involved in the receipt, hot cell processing, and dispersal of multicurie quantities of the La^{140} tracer are described. Radiation and contamination controls were maintained, such that there were no inadvertent radiation over-exposures above the maximum permissible limits set for personnel for the operation. Types and quantities of equipment and instrumentation required for an operation of this type are given. A case of ionic skin contamination is described, including decontamination procedure and dosimetry calculations. Recommendations are made for the improvement of radiological safety operations in future operations. (auth)

23148 CEA-tr-A-694
LA DETERMINATION DE LA RADIOACTIVITÉ ÉLEVÉE DANS LES PRODUITS DE CONDENSATION DES AÉROSOLS. (Determination of the Increased Radioactivity in Condensation Products of Aerosols). L. Holzapfel, H. Cauer, and R. Reiter. Translated into French from Naturwissenschaften 45, 159-60(1958). 5p.

A study was made of the unusual increase in the activity of aerosol condensation products in October, 1957. Dried condensation products collected at Berlin-Dahlem were measured with a Philipps scintillation counter with an Al window. The curves show a rise to a peak of 6400 counts/min on October 15 beginning on October 13. The count rate drops back to 4500/min on the seventeenth. (T.R.H.)

23149 CWL-550-P-28
RADIOACTIVITY IN THE ATMOSPHERE. STRATOSPHERE—A RESERVOIR FOR RADIOISOTOPES. (Promieniotwórcze Skażenie Atmosfery. Stratosfera Magazynem Radioizotopii). Translated by B. Wojciechowska from Zycie Warszawy (1959) Mar. 12. 7p.

Papers are summarized which were presented during a two-day conference, held in Warsaw, dealing with radioactivity caused by nuclear bomb explosions. The results of surveys carried out at nine stations throughout the country and by a Polish polar expedition to Spitsbergen are discussed. The stratosphere is pictured as a huge hanging reservoir of radioisotopes from which dangerous dust will fall-out on Earth for many decades, even if no more experimental explosions occur. Results of measurements of the amount of strontium-90 in the bones of the Polish population and the distribution in man and animals of iodine-131 produced by nuclear explosions are also discussed. It was concluded that radioactivity in the biosphere over Poland so far presents no danger for the Polish population. (C.H.)

23150 DEG-Inf. Ser. 6
PRACTICAL ASPECTS OF PROTECTION AGAINST RADIATION IN LABORATORIES USING RADIOELEMENTS. J. Pradel. Translated by P. J. Robinson (U.K.A.E.A., Risley) from Énergie Nucléaire 1, 77-84(1959). 18p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 17690.

23151 DEG-Inf. Ser. 30
LOWERING THE PERSONAL DOSE BY USING AN INDIVIDUAL RADIATION-WARNING DEVICE. D. Frost. Translated by R. Presser (U.K.A.E.A., Risley) from Atompraxis 5, 310-13(1959). 9p.

Devices for individual radiation warning are discussed. Design and operation of a battery-operated pocket warning device that produces an alarm sound whose frequency increases in proportion to the dose are described. (J.R.D.)

23152 JPRS-5025
ATMOSPHERIC AIR POLLUTION WITH RADIOACTIVE SUBSTANCES. V. F. Oreshko and Yu. V. Novikov. Translated from Gigiena i Sanit. 25, No. 2, 64-70(1960). 12p. OTS.

Atmospheric air pollution by radioactive substances is discussed relative to removal, dilution, and areas of concentration. 36 references. (C.J.G.)

23153 JPRS-5360
CONTAMINATION OF THE SKIN BY RADIOACTIVE SUBSTANCES AND COMPARATIVE EFFECTIVENESS OF CERTAIN METHODS OF PURIFICATION. L. A. Il'in. Translated from Gigiena Truda i Professional. Zabolevaniya 4, No. 3, 28-32(1960). 8p. OTS.

Experiments were conducted on the dynamics of contamination and the effectiveness of some decontamination methods for the skin. The wrist up to the metacarpal articulation was immersed in a radioactive solution of carrier-free Y^{91} and P^{32} as Na$_2$HPO$_4$. Beta activity was measured after the various exposure and decontamination treatments. The decontamination methods studied were: dry rag, powdered pumice, 5% Na$_2$HPO$_4$, water plus 40% soap, 2% HCl, 3% citric acid, and cationite "vofatit." It was concluded that strict adherence to dosimetry rules is essential. The dynamics of washing P^{32} and Y^{91} off the skin has a definite regularity conditioned by at least three layers of contamination. Substances with nonisotope carriers are more firmly bound by the skin. The tested methods do not ensure complete removal of Y^{91} and P^{32} but washing with water and 40% soap followed by 2% HCl and a water rinse is recommended. (T.R.H.)

23154

RADIATION PROTECTION IN ASSOCIATION WITH BARE RADIOACTIVE MATERIALS. PART II. H. Götte. Atompraxis 6, 148-54(1960) Apr.-May. (In German)

A description is given of the measures of organization necessary for safe handling of radioactive material and the methods for supervising the hazards of contamination. Furthermore, radioactive decontamination and removal of radioactive waste are briefly referred to. An annexal survey of different types of laboratories demonstrates the methods of furnishing these places in regard of the activities handled. (auth)

23155

ASPECTS OF THE CONTROL OF RADIATION EXPOSURE. D. J. Mathias and J. R. A. Lakey. G. E. C. Atomic Energy Rev. 2, 172-6(1960).

A description is given of how comparatively simple modifications to standard x-ray machines have enabled weld radiography to be carried out on the site safely and conveniently. An indication is given of the types of hazard likely to be encountered during the operation of a nuclear power station. The general principles for dealing with these hazards are discussed. (B.O.G.)

23156

CURRENT STATE OF PRESERVATION OF FOOD PRODUCTS BY MEANS OF IONIZING RADIATIONS. [PART] I. N. Satinover. Ind. aliment. Produse animale 7, No. 1, 3-6 (1959). (Translated from Referat. Zhur. Khim. No. 20, 1959, abstract No. 72947).

A review was made of the properties of ionizing radiations and their action on microörganisms that caused spoilage of food products and the changes induced in the food by action of ionizing radiations.

23157

PERSONNEL DECONTAMINATION UNITS AT BROOKHAVEN NATIONAL LABORATORY. R. A. Love (Brookhaven National Lab., Upton, N. Y.). Intern. Rec. Med. 173, 365-8(1960) June.

The design of a decontamination suite is described which was incorporated in the medical research center for use in the event of a major radioactive contaminating accident. It is suggested that serious thought be given to the incorporation of such a unit in general hospitals for use in case of possible contamination from industrial accidents or radiological warfare. (C.H.)

23158

NEW FISSION PRODUCTS IN THE ATMOSPHERE. V. Mageru, D. Blånariu, and I. Gabe (Sectia de Cercetări fizice, Academia R. P. R., Jassy). Naturwissenschaften 47, 319(1960). (In German)

Since the autumn of 1958 daily measurements of the radioactivity of atmospheric fallout have been made in Jassy. The rain water and atmospheric duct were collected, and the activity was determined with G-M counters. The results show that since the suspension of atomic bomb explosions in Nov. 1958, the activity was still large in the spring and summer of 1959, but it fell in the autumn of 1959, and reached a mean level of about 30 μc/km^2 in the winter of 1959/60. After Feb. 20, 1960, a new increase in the activity was noted. The samples from Feb. 23 to Feb. 25, 1960, and from Mar. 16 to Mar. 20, 1960, were characterized by an activity which reached a level of 1000 c/km^2. It was concluded that the maxima observed in Feb. and Mar. originated from the Sahara nuclear explosion on Feb. 13, 1960. (J.S.R.)

23159

HEALTH PHYSICS INSTRUMENTATION. [PART] 5. Denis Taylor (Plessey Nucleonics Ltd., [Northampton, Eng.]). Nuclear Power 5, No. 52. 91-4(1960) Aug.

Data handling and processing problems in health physics monitoring systems in more elaborate nuclear plants are discussed. The discussion includes the following subjects: installed instrumentation, automation and film badge service, automation and radio assay, and radiation monitoring of large areas. (B.O.G.)

23160

THE DANGER OF RADIATION IN STORING OF MONASITE SANDS. J. Sýkora, A. Kubát, and F. Hůzl (Pilsen State Univ. of Physics, Czechoslovakia). Pracovní lekařství 12, 291-4(1960) June. (In Czech.)

A saturated layer, seven cm deep, of monazite sand was placed in the laboratory and the increase of activity on the surface over the freely strewn monazite sand was measured. The level of gamma radiation in a store of monazite sand was from 7 mr/hour to 0.4 mr/hour and in samples of the dust it was about 70 impulses per minute at 2 cm from a beta–gamma window-probe (4 mg/cm^2). It is recommended to orientate the supplies of monazite sand for storage with the smallest surface toward the workers. Only in one case slight subjective complaints occurred in exposed workers. No objective signs of damage were, however, ascertained in short term observation. (auth)

23161

A STUDY OF THE HAZARDS IN THE STORAGE AND HANDLING OF LIQUID HYDROGEN. L. H. Cassutt, F. E. Maddocks, and W. A. Sawyer (Arthur D. Little, Inc., Cambridge, Mass.). p.55-61 of "Advances in Cryogenic Engineering. Volume 5. Proceedings of the 1959 Cryogenic Engineering Conference, University of California, Berkeley, California, September 2-4, 1959." K. D. Timmerhaus, ed. A Cryogenic Engineering Conference Publication. New York, Plenum Press, Inc., 1960.

A study showed that liquid hydrogen is much safer to handle than many other rocket propellants. When accidentally mixed with air under unconfined conditions, it does not detonate, and radiation effects from any fire are less than those of more conventional fuels. Its low initiation energy requirements and its wide flammability limits make ignition of any vapor cloud more likely. For that reason, more care should be taken to remove all potential causes of these conditions from an area where liquid hydrogen is stored or handled. (B.O.G.)

23162

MANAGEMENT OF NUCLEAR MATERIALS. Ralph F. Lumb, ed. Princeton, New Jersey, D. Van Nostrand Co., Inc., 1960. 523p. $16.50.

This volume deals with the control of the two principal nuclear materials uranium and plutonium. It covers their management through the entire chain of atomic energy activities—mining, ore and feed materials processing, reactor fuel element fabrication, reactor operation, full separation and recovery, scrap recovery, and research and development. (W.L.H.)

23163
Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA QUARTERLY REPORT. Volume 1, No. 4. July 1960. 117p. $0.50(OTS).

Data are presented on the levels of radioactivity in samples of milk, air, water, human bone, food, fish, and soils collected throughout the United States during 1960. Data are summarized on the activity found in similar samples during 1957, 1958, and 1959. (C.H.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

23164 AD-236495
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE FEASIBILITY OF MIXING ISOTOPES TO SIMULATE THE GAMMA ENVIRONMENT OF NUCLEAR SYSTEMS (thesis). William Waldrop Monday. Mar. 1960. 64p.

Mixtures of isotopes to simulate gamma environments of nuclear systems are studied. The uranium-235 prompt gamma-ray fission spectrum is selected as a model. Cobalt-60, iridium-192, scandium-46, antimony-124, europium-152, cesium-137, and cerium-144 are used in trial mixtures. A comparative analysis based on cost, half life, and gamma spectrum is made for three mixtures. The 7-isotope mixture has a fair photon match, but replenishment cost is high. The 2-isotope mixture (cobalt-cesium) is least expensive but has only 3 peaks in its spectrum. The 3-isotope mixture (cobalt-cesium-europium) offers the best compromise between cost and gamma spectrum and is recommended for a gamma environmental test facility. (auth)

23165 NP-8890
General Electric Co. X-Ray Dept., Milwaukee.
STUDY OF CAUSE AND PREVENTION OF UNDESIRABLE ODORS AND FLAVORS IN IRRADIATED PROTEINS AND AMINO ACIDS. Report No. 6 (Final) Covering the Period October 1, 1956 to January 31, 1959. W. Dexter Bellamy. 83p. Project No. 7-84-01-002; Contract DA19-129-QM-837.

The isolation and identification of some of the irradiation products from egg albumin and zein are reported. The techniques of fractional distillation at reduced pressure, of gas chromatography, of paper chromatography, of mass spectrometry, and of infrared analysis used are described. A correlation of irradiation odor with some products was found, but the complete identification of the irradiation odor was not made. The effect of specific functional group reagents upon the odor of irradiated proteins and on distillation fractions was determined. The effect of masking agents such as hydrogen peroxide and pyruvate, as well as acetylation and benzylation, on the irradiation odor are recorded. The effect of grinding, of irradiation atmosphere, and of source of fat on the irradiated beef odor was determined. (auth)

23166 NP-9009
Southern Research Inst., Birmingham, Ala.
DETERMINING THE FUNCTIONAL PROPERTIES OF FOOD CONTAINERS USED FOR FOODS IRRADIATED IN COMBINATION WITH MODEL FOOD SYSTEMS. Report No. 19 (Progress) [for] July 25, 1959—September 24, 1959. Charles F. Feazel. Project No. 7-84-01-002. Contract DA-19-129-QM-759.

Results are presented from a study of the factors that affect stress-cracking and the production of extractives in plastic packaging materials that are to be used with foods preserved by irradiation. Polystyrenes, polyamides, polyesters, and polypropylenes were tested in homogenized milk, in solutions of Igepal CO-630, and solutions of lactic acid, and in water slurries of ground beef, ground pork, pork sausage, cheese, fish, apples, and green beans. All materials, except polyesters, received 1.0, 3.0, and 6.0 megarads of gamma radiation. Polyesters received 6.0 megarads of gamma radiation only. Unirradiated samples were also tested with the solutions. The super-high shock resistant polystyrenes were the most resistant to stress-cracking; irradiation increased their resistance further. Sausage and cheese slurries caused the most stress-cracking of polystyrenes; Igepal CO-630 and lactic acid solutions affected only a few of the polystyrenes. Polyesters, polyamides, and polypropolene were not affected by any of the media. Polyesters irradiated in water had no off odor. There was a correlation between the amount of rubber present and the odor of irradiated polystyrenes. (auth)

23167 NYO-2753
Isotopes, Inc., Westwood, N. J.
STUDY OF THE GENERAL FEASIBILITY OF RADIOISOTOPES METHODS IN THE NATURAL GAS INDUSTRY. July 1, 1960. 124p. Contract AT(30-1)-2400. OTS.

A review is presented in which the attributes and limitations of nuclear methods for the natural gas industry are examined. Major problem areas such as leak detection, pipe erosion, storage mechanics, and others are outlined. It is noted that the use of radioisotopes does not replace the use of conventional engineering practices, however as a parallel or additional tool they have a worth-while place in the gas industry. Recommendations regarding the applicability and feasibility of radioisotopic methods are included. (J.R.D.)

23168 NYO-9139
Consolidation Coal Co. Research and Development Div., Library, Penna.
UTILIZATION OF RADIOACTIVE ISOTOPES IN COAL PROCESS RESEARCH. Quarterly Technical Status Report No. 5 [for] May 1, 1960—July 31, 1960. P. M. Yavorsky and E. Gorin. Aug. 15, 1960. 18p. Contract AT(30-1)-2350. OTS.

Development of tracer techniques using tritium, exploring the problems of tritium location, and isotope exchange as functions of hydrocarbon type were continued. Specific oxidation of labeled tetralin to phthalic acid revealed that 66% of the tritium appears to be in the aromatic positions. Phosphoric acid isotopic exchange does not appear to be strictly selective, further work is required to test the procedure used to investigate this reaction. Low-level tritium assays by dry combustion of organic samples followed by liquid scintillation counting of product water appears to be more dependable than the zinc fusion-ion chamber method. (See also NYO-2597.) (auth)

23169 CEA-tr-X-202
L'ISOTOPE SAMARIUM 153 DONNE DES RAYONS-GAMMA MOUS AVEC GRANDE INTENSITÉ. (The Isotope Samarium-153 Emits Gamma Rays of High Intensity). L. G. Davis. Translated into French from Electronica 12, 278, 83(1959). 4p.

The use of Sm^{153} sources for radiography, liquid-level gages, density gages, and thickness gages is discussed. The isotope emits γ radiation at 42.7 and 103 kev but has a half life of only about 2 days. (T.R.H.)

23170 NP-tr-469

APPLICATION OF RADIOISOTOPES IN HYDROLOGY AND HYDRAULICS. PARTS I AND II. (Die Verwendung von Radioisotopen in der Hydrologie und Hydraulik). A. Montens. Translated by F. Hudswell (U.K.A.E.A. Atomic Energy Research Establishment) from Atompraxis 5, 91-3; 182-7(1959). 30p. (Includes 5p. of original). JCL.

This paper was previously abstracted from the original language and appears as Parts I and II in NSA, Vol. 13, as abstracts No. 13125 and 13869, respectively.

23171

METALLIC REINFORCING SCREENS IN GAMMAGRAPHY. Guy Courtois (Commissariat à l'Énergie Atomique, Saclay, France). Fonderie No. 162, 12p. (1959) July. (In French)

Some aspects of the theory of metallic reinforcing screens are reviewed. The technique of gammagraphy reached the industrial stage some thirty years ago, but its true development took place parallel with that of nuclear reactors. Characteristics of several emitters which are or can be used are given. This list is not restrictive, and at the last Geneva Conference new gammagraphic tendencies were defined. The use of slowing-down radiation (bremsstrahlung) was developed by the production of compounds in which one of the elements is an electron emitter such as promethium-147 or thallium-204 and another heavy element acts as a target. Thus the development of promethium tungstate and thallium iodide was brought about. There is a marked preference for polychromatic emitters. Thus cesium-134 is preferred to cesium-137. Sources are also made with mixtures of iridium-192 and tantalum-182. From these last achievements it can be affirmed that new tools will soon be available for gammagraphy. (auth)

23172

TOMOGRAPH FOR INDUSTRIAL RADIOGRAPHY. D. Charles (Imperial Chemical Industries Ltd., Birmingham, Eng.). J. Sci. Instr. 37, 257-8(1960) Aug.

Tomography is a radiographic technique originally developed for medical purposes, in which relative movements of x-ray tube, subject, and film are controlled so that a defined section of the subject is recorded as a sharp image, superimposed on a diffuse background due to blurred images of the rest of the subject. A tomograph for industrial use was developed, and its capabilities were assessed by tests on an assembly of wire mesh gauzes. Its practical application was demonstrated with two types of heat exchangers, on which useful detailed observations were made. Tomography is considered to be particularly effective for examination of such assemblies in which repetitive detail is masked by overlying layers. (auth)

23173

FUTURE FOR FOOD IRRADIATION. COSTS REDUCED BY NEW ACCELERATOR. Wolfgang Huber and August S. Klein. Nuclear Energy, 371-2(1960) Aug.

The cost of processing foods by radiation, especially the capital investment, is expected to be significantly reduced by the L-band traveling wave linear accelerator. Cost calculations are given for commercial, low-dose radiation processing of foods with the S-band and the L-band linac. Costs per pound of a radiopasteurizing dose of 0.25 megarad is compared for the L-Band and S-Band linac, cobalt-60, and cesium-137 for beam utilization of 25 and 50%. Studies indicate that radiopasteurization can be equally useful with meats, fish, produce, and a variety of other products, either fresh or prepared that are prone to quick spoilage. (B.O.G.)

23174

DIFFUSION OF RADIOACTIVE LEAD IN LEAD METASILICATE GLASS. R. Lindner, W. Hassenteufel, and Y. Kotera (Technische Hochschule, Göteborg). Z. physik. Chem. (Frankfurt) (N. S.) 23, 408-14(1960) Mar. (In German)

The diffusion of lead isotopes Pb^{210} and Pb^{212} in lead metasilicate glass was measured in the range 300 to 600°C, and the activation energy for self-diffusion was found to be 24.8 kcal. A comparative discussion of previously published values for cation mobility in crystallized, glass-form, and molten silicates of Pb and Na is given. In the case of Pb metasilicates, a great similarity between the glass-form and the molten condition with respect to ionic mobility can be shown through comparison of cation self-diffusion in the crystallized or glass-form material to ionic conductivity measurements on melts. (tr-auth)

23175

Atomic Energy Commission, [Washington, D. C.]. USES OF ISOTOPES IN INDUSTRY AND IN PHYSICAL AND CHEMICAL RESEARCH. 1959. 20p.

The uses of radioisotopes in physics, general chemistry, physical chemistry, and organic chemistry research are described. The uses of radioisotopes in industry for thickness gages, density gages, liquid-level gages, sterilization, and tracer studies are reported. (W.L.H.)

23176

IMPROVEMENTS IN OR RELATING TO RADIO-ACTIVE SUBSTANCES. Edward James Wilson and John Duncan Horsfall Hughes (to United Kingdom Atomic Energy Authority). British Patent 843,838. Aug. 10, 1960.

A method is presented for the manufacture of light sources by incorporating Kr^{85} into a phosphor. A solution of quinol in 25% EtOH$-$75% H$_2$O solvent is saturated with Kr^{85}-containing krypton and then cooled so that small crystals of the quinol-krypton clathrate compound separate. This powder is suitable for incorporation into phosphorescent materials by mixing it with a phosphor, e.g., activated ZnS, and adding to it a vehicle containing binder to form a paint or adding a powdered thermoplastic material to form a molding composition. Since the range of β particles emitted by Kr^{85} is ~1 mm in such materials, optimum brightness is reached with paint thickness >1 mm; thicknesses of 2 to 3 mm are suitable. The clathrate-phosphor proportion is 1 to 10 for optimum brightness. Specific examples are given for the preparation of the clathrate and its incorporation. Light brightness data are given for 2- to 3-mm paint films consisting of the clathrate, polymethyl methacrylate binder, and quinol-saturated trichloroethylene vehicle at time intervals after fabrication from 5 to 500 days; it is seen that the brightness is very strong even after extensive darkening and remains 3x to 5x stronger than radium paints after 500 days. Variants of the method are discussed; Kr^{85} might be replaced by tritiated H$_2$S, and the clathrate could be used as a radioactive source. (D.L.C.)

23177

AN IMPROVED BALANCING UNIT FOR USE WITH RADIATION GAUGES. (to Gordon Francis Wellington Powell). British Patent 843,856. Aug. 10, 1960.

A description is given of an adjustable balancing unit for use with a radiation gage for the measurement of the mass of a moving material, e.g., a moving tobacco filler in a continuous-rod cigarette-making machine. The unit is similar to the gage, but it has an absorber between its radioactive source and detector equivalent to the desired mass of the moving material; the currents from the unit and gage oppose each other and thus variations in the moving material may be measured. The absorber comprises a pair of eccentric rotatable metal disks with edges touching in front of the detector window; by suitable rotation of the disks, the absorption value of the unit can be varied. (D.L.C.)

23178
METHOD OF PRODUCING RADIOACTIVE SOILS FOR CLEANING TESTS. (to Bendix Aviation Corp.). British Patent 844,334. Aug. 10, 1960.

A method is given for producing radioactive soils for tests of the efficacy of cleaning methods and is suitable for the following types of soils: clay, sand, powdered rock, metal oxides, field dirt, and dusts. The method consists of thoroughly mixing the soil with an ORNL radioactive Cs solution (Cs 134-P in 1 N HCl), allowing to stand for ½ hour or until enough radioactivity is absorbed by the soil, evaporating off the excess H_2O, washing the soil with soap solution and rinsing repeatedly until the rinse water is no longer radioactive, and drying the soil. Four procedures are given for the treatment in the above manner of clay, sand, chromium oxide, and dust. (D.L.C.)

ISOTOPE SEPARATION

23179 CISE-76
Centro Informazioni Studi Esperienze, Milan.
PROGETTO DI UN IMPIANTO PER L'ARRICCHIMENTO FINALE DI SOLUZIONI ACQUOSE DI D_2O FINO ALLA CONCENTRAZIONE DEL 99,8%. PARTE I. PROGETTO CHIMICO FISICO DELL'IMPIANTO. (Design of a Plant for Final Enrichment of Aqueous Solutions of D_2O Up to a Concentration of 99.8%. Part I. Chemical Design—Physics of the Plant). S. Finzi, C. Marchetti, R. Renzoni, and M. Silvestri. June 1960. 50p.

The first of four reports on the design of a plant for producing 99.75 mole % D_2O from preconcentrated solutions is presented. The isotopic and chemicophysical design is treated, all the necessary theoretical considerations for the calculations being given. (T.R.H.)

23180 CISE-77
Centro Informazioni Studi Esperienze, Milan.
PROGETTO DI UN IMPIANTO PER L'ARRICCHIMENTO FINALE DI SOLUZIONI ACQUOSE DI D_2O FINO ALLA CONCENTRAZIONE DEL 99,8%. PARTE II-A. PROGETTO E COSTRUZIONE DEL'ELEMENTO-TIPO. ESPERIENZE DI FUNZIONAMENTO. (Design of a Plant for Final Enrichment of Aqueous Solutions of D_2O Up to Concentrations of 99.8%. Part II-A. Design and Construction of the Type Elements. Operating Experiments). S. Finzi, C. Marchetti, R. Renzoni, and M. Silvestri. June 1960. 68p.

The prototype elements for the plant for D_2O enrichment were constructed and operated. The system has two variations corresponding to a feed and a D_2O concentration function for 2% D_2O and 50% D_2O, respectively. It is made up of three (with 2% feed) or two (with 50% feed) groups of electrolytic cells and four (with 2% feed) or three (with 50% feed) groups of elements, each with a saturation-evaporation unit, a reaction chamber for isotope exchange on a catalyst, and a condenser–separator. The dimensions of these elements are determined primarily by the throughput of H_2 and water. The element complex was constructed and operated on a laboratory basis to obtain data necessary for the final design. (T.R.H.)

23181 CISE-78
Centro Informazioni Studi Esperienze, Milan.
PROGETTO DI UN IMPIANTO PER L'ARRICCHIMENTO FINALE DI SOLUZIONI ACQUOSE DI D_2O FINO ALLA CONCENTRAZIONE DEL 99,8%. PARTE II-B. DISEGNI COSTRUTTIVI DELL'ELEMENTO-TIPO. (Design of a Plant for Final Enrichment of Aqueous Solutions of D_2O Up to a Concentration of 99.8%. Part II-B. Construction Design of Type Elements). S. Finzi, C. Marchetti, R. Renzoni, and M. Silvestri. June 1960. 13p. 6 illus.

Drawings and photographs to accompany CISE-77 are presented. (T.R.H.)

23182 CEA-tr-A-613
PROCÉDÉ DE DÉSHYDRATATION (CONCENTRATION) DU CATALYSEUR DANS DES INSTALLATIONS D'ÉCHANGE POUR L'ENRICHISSEMENT EN DEUTÉRIUM. (Process for Dehydration (Concentration) of the Catalyzer in Exchange Apparatus for Concentration of Deuterium). Rolf Manteufel. Translated into French by R. Carbonnier from German patent No. 1 046 590. 10p.

A process is described for dehydration of the catalyzer in installations where deuterium is enriched in columns by isotopic exchange between hydrogen and water, especially in those processes where the deuterium exchange is combined with hydrogen production by phase inversion. The catalyzer is dried by evaporation in a current of depleted hydrogen, thus avoiding complications and disadvantages associated with high temperatures or vacuum drying. (T.R.H.)

23183 JPRS-3694
SEPARATION OF ISOTOPES IN AN ULTRACENTRIFUGE. Anatol Selecki. Translated from Nukleonika 4, 13-33(1959). 20p. OTS.

Problems of separation of isotopes in an ultracentrifuge are discussed. Basic design features of recent ultracentrifuges are described. Essential elements of the theory of isotope separation in an ultracentrifuge are outlined. Experimental results are reviewed. (auth)

23184 JPRS-5064
INDUSTRIAL METHODS OF OBTAINING HEAVY WATER. N. M. Zhavoronkov and K. I. Sakodynskii (Sakodynskiy). Translated from Khim. Prom. No. 3, 35-48(1959). 65p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 2645.

23185 JPRS-5289
SEPARATION FACTORS OF BORON ISOTOPES IN THE EQUILIBRIUM VAPORIZATION OF BORON TRIFLUORIDE. N. N. Sevryugova, O. V. Uvarov, and N. M. Zhavoronkov. Translated from Zhur. Fiz. Khim. 34, 1004-8(1960). 11p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 18089.

23186
STATISTICAL–THERMODYNAMIC CALCULATION OF THE EQUILIBRIUM CONSTANTS FOR A CHEMICAL ISOTOPE EXCHANGE REACTION FOR C^{13} SEPARATION. G. Vojta (Institut für Physikalische Stofftrennung, Leipzig). Monatsber. deut. Akad. Wiss. Berlin 1, 429-31(1959). (In German)

Isotope separation by chemical reaction is a typical quantum process which can be treated by the methods of statistical thermodynamics. These methods are applied to reactions involving C^{13} exchange. (T.R.H.)

23187
KINETICS OF THE ISOTOPE EXCHANGE IN HETEROGENEOUS SYSTEMS WITH MULTIPLE EQUILIBRIA. F. Scheffer, B. Ulrich, P. Benecke, and W. Sendler (Uni-

versität, Göttingen, Ger.). Naturwissenschaften 47, 321 (1960). (In German)

The mathematical treatment of isotopic exchange reactions was synthesized from the time law of simple (homogeneous) exchange reactions in a binary system. If the isotope exchange is followed at equilibrium and at constant temperature, the complex exchange curve can be reduced to its individual reactions. Hydroxyl apatite was chosen as the equilibrium system and the exchange was studied with P^{32}. Typical results were tabulated. (J.S.R.)

23188
THE SEPARATION OF DEUTERIUM ON AN INDUSTRIAL SCALE BY LOW-TEMPERATURE DISTILLATION. M. P. Malkov, A. G. Zel'dovich, A. B. Fradkov, and I. B. Danilov (Inst. of Physical Problems, Academy of Sciences, Moscow). p.69-86 of Progress in Cryogenics. Volume 2." K. Mendelssohn, ed. New York, Academic Press Inc. 1960.

A discussion is given on the development of a cycle for the separation of deuterium on an industrial scale. The technological problem of obtaining heavy water arises from the small concentration of deuterium in natural hydrogen and hydrogenous compounds (about 1 part in 7,000). The main considerations are discussed for the separation of deuterium by the low-temperature distillation of liquid hydrogen. The costs of producing heavy water by various methods are compared. (B.O.G.)

MATHEMATICS AND COMPUTERS

23189 AFCRC-TN-59-797
Northeastern Univ., Boston. Electronics Research Lab.
A BIBLIOGRAPHY OF PUBLICATIONS IN THE THEORY OF GAMES. Scientific Report No. 1. H. Stephen Schloss. Oct. 23, 1959. 96p. Contract AF19(604)-4573. (AD-234153).

23190 AFOSR-TN-60-746
Syracuse Univ., N. Y.
THE CONSTRUCTION AND PROPERTIES OF NONEQUILIBRIUM GIBBSIAN ENSEMBLES. Robert L. W. Chen. July 1960. 33p. Contract AF49(638)-461.

The methods of constructing Gibbsian ensembles for isolated systems undergoing irreversible processes are discussed and the properties of these ensembles are examined in detail. Different kinds of physical situations call for different types of representative ensembles. In particular, contrast situations are contrasted in which: (1) the system is just beginning an irreversible process, and (2) the system has had some uninterrupted past history. It is believed that these basic considerations would enable one to resolve some apparent contradictions described in current literatures. (auth)

23191 AFOSR-TN-60-824
Syracuse Univ., N. Y.
A STATIONARY GIBBSIAN ENSEMBLE. Walter Louis Sadowski. July 1960. 55p. Project R 354-10-20. Contract AF49(638)-461.

The Bergmann-Lebowitz equation is derived by integrating the Liouville equation over domains of collision of system particles with those of the reservoir. Thereby a more direct insight is afforded into the physical aspects of the Bergmann-Lebowitz equation. On the basis of a specific physical model the stationary non-equilibrium distribution function is investigated. The kernel of the non-equilibrium problem is expanded in a power series of the temperature difference across the system. The expansion obtained contains the temperatures of the two reservoirs in the zeroth-order of the distribution function. The resulting zeroth-order distribution function contains numerical factors which make it slightly different from the equilibrium distribution. The physical significance of these factors is discussed. A specific property of the perturbative kernel is used to find the approximate solution to the first-order perturbative equation. The result is an approximate solution since certain boundary conditions are not satisfied exactly. The error incurred is estimated to be small. An estimate is given. The error can be neglected under the conditions that the temperature difference between the reservoirs is small and the system is long. The one-particle distribution function in μ-space is obtained by integrating the first-order n-particle distribution function. An expression is given for the transport of heat along the system's axis. It is shown that the resulting heat flux is proportional to T_2-T_1/Q_2-Q_1 where Q_2-Q_1 is the length of the system's container along the axis of symmetry. This result is obtained without the usual assumption of local equilibrium or the assumption that a local temperature can be defined. (auth)

23192 AWRE-0-20/60
United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
THE PREPARATION OF NUCLEAR DATA FOR USE IN NEUTRONICS CALCULATIONS ON HIGH SPEED COMPUTERS. J. B. Parker and K. Parker, eds. June 1960. Reprinted Aug. 1960. 40p.

The AWRE Punched Card Library of Neutron Cross Sections is described together with the way in which this is used to calculate group constants for use in Monte Carlo calculations. Although the programs described are those for IBM-704 and IBM-709 machines the principles involved are of great generality. Appendices give full details of card layouts. (auth)

23193 IS-137
Ames Lab., Ames, Iowa.
AN IBM 650 COMPUTER PROGRAM FOR DETERMINING THE THERMAL DIFFUSIVITY OF FINITE-LENGTH SAMPLES. William Leon Kennedy. June 1960. 59p. Contract W-7405-eng-82. OTS.

A technique was developed for measuring the thermal diffusivity of finite-length samples. The sample was in the form of a round rod surrounded by a cylindrical guard. Both the sample and the guard had a small heater attached to one end. The heater was turned on and the voltages of equally spaced thermocouples were plotted as a function of time. This procedure determined the boundary conditions necessary for the solution of the heat flow equation. The solution at the sample midpoint was obtained by assuming various values of thermal diffusivity. The value of thermal diffusivity which gave the best agreement between the computed solution at the sample midpoint and the experimental curve obtained at the midpoint was considered to be the best value for the thermal diffusivity. (auth)

23194 KAPL-2000-10(p.F.1-F.5)
Knolls Atomic Power Lab., Schenectady, N. Y.
A CODE FOR THE GENERAL SOLUTION OF A CONICAL SHELL SUBJECT TO AXISYMMETRIC LOADS. L. Deagle and M. C. Ray.

A computer code is described which was developed for the purpose of computing the stresses resulting from start-up and shutdown thermal transients in cylindrical reactor pressure vessels having nonuniform wall thickness and moderately tapered transition sections. The code calculates the deflection, slope, and stresses from a numerical method for a shell of revolution having a linearly varying wall thickness and a linearly varying radius. (W.D.M.)

23195 KAPL-M-JA-7(Rev.I)
Knolls Atomic Power Lab., Schenectady, N. Y.
KARE GENERAL MESH DATA. J. A. Archibald, Jr. May 6, 1960. Revised July 22, 1960. 17p. Contract W-31-109-eng-52. OTS.

23196 SCTM-248-55(51)
Sandia Corp., Albuquerque, N. Mex.
IMPROVEMENT OF MONTE CARLO PRECISION. H. D. Brunk and G. P. Steck. Dec. 30, 1955. 32p. OTS.

Several methods are described by which the accuracy of Monte Carlo estimates of probabilities or, equivalently, of integrals can be improved. These methods are applied to a particular problem for purposes of illustration and their accuracies compared. (auth)

23197 TID-6199
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
1. FLOW DIAGRAMS. 2. THE ESTIMATION OF SIGNIFICANCE. R. D. Richtmyer. Apr. 25, 1960. 29p. Contract AT(30-1)-1480. OTS.

The rules for constructing and interpreting a mathematical flow diagram which describes a computational procedure are discussed. Methods for estimation of significance in numerical calculations are given. (C.J.G.)

23198
THE DEVELOPMENT OF NUCLEAR CODES IN JAPAN. II. LIST OF NUCLEAR CODES IN JAPAN. Tasaburo Yamada and Toshio Aoki (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 412-23 (1960) July. (In Japanese)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

23199 AERE-MET-MIS-4
[United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England].
COMPARISON OF SEVERAL METHODS OF PRODUCING URANIUM AND THORIUM POWDERS. [1957?] 1p.

23200 AFOSR-TN-60-693
Franklin Inst. Labs. for Research and Development, Philadelphia.
APPARATUS FOR ZONE REFINING HIGHLY REACTIVE METALS. Interim Report. G. E. Spangler, M. Herman, and J. L. Rutherford. July 1960. 12p. Contract AF18(600)-1581. (I-A1878-5).

An apparatus for the purification of highly reactive metals by the floating zone technique is described. The design consists of a hermetically sealed, all glass system using a static inert atmosphere which is internally gettered. The apparatus includes a water cooling jacket around the protection tube and an improved magnetic vertical adjustment device which permits external control without an additional seal. (C.J.G.)

23201 DP-314
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
FUEL MELTDOWN EXPERIMENTS. James R. Seaboch and James W. Wade. Oct. 1958. Decl. May 12, 1960. 42p. Contract AT(07-2)-1. OTS.

Fuel tubes of enriched uranium–aluminum alloy were melted to various degrees of severity in the SPERT I reactor as a part of a program to evaluate reactor operating hazards. The heat flux encountered during the tests ranged from 200,000 to 650,000 PCU hr/cu ft. The time required for the metal temperature to reach the melting point from the time when burnout began varied from 1.3 to 4.9 sec. During these tests pressure pulses were produced at a frequency of about one per second with peaks of about 150 psi. From the most severe meltdown, about 7% of the mass of the fuel tube was recovered as particles, which varied in size from tiny flakes to a jagged agglomerate weighing 37 g. The aluminum housing tube surrounding the fuel tube did not exceed about 170°C, and the temperature of the aluminum tube, which contained the fuel housing, did not greatly exceed the ambient temperatures. No chemical reactions occurred, and no detectable amount of uranium remained suspended in the water after the tests. (auth)

23202 KLX-10077
Vitro Labs., West Orange, N. J.
ELECTROKINETIC PROCESSES—NUCLEAR ASPECTS. Quarterly Progress Report [for] February 1–April 30, 1957. Vitro Job 2091. A. C. Werner and H. Katz. May 15, 1957. Decl. June 10, 1960. 9p. Contract AT(30-1)-1996. OTS.

A number of coatings was investigated for protection of graphite against high-temperature oxidation and erosion. Well-sintered, well-bonded silicon carbide coatings were obtained by depositing elemental silicon on graphite, densifying, and sintering in CO at 1300 to 1400°C. However, the coatings were not perfect since complete protection was not offered against oxidation. A 75-15-10 nickel–chromium–silicon alloy sintered at 1100, 1200, and 1300°C wet graphite very well, whereas coatings with high metallic luster were obtained at the higher temperatures. Fecral, alumina, and chromium–silicon–iron–aluminum alloys were deposited electrophoretically on graphite. Although excellent green coatings were obtained, sintered coatings were poor. The fecral coatings did not wet the surface, and the alumina coatings were brittle and non adherent indicating that a higher temperature was necessary. (For preceding period see KLX-10065.) (auth)

23203 LM/TAB-15
MSA Research Corp., Callery, Penna.
LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR PERIOD OF APRIL, MAY AND JUNE 1960. 5p.

Abstracts of current literature on liquid metals are presented. Nine abstracts are included. (J.R.D.)

23204 MET-52
Atomic Energy of Canada Ltd., Chalk River, Ont.
REACTOR GRADE ZIRCALOY-2 INGOT. E. C. W. Perryman. July 15, 1960. 6p.

23205 NASA-TN-D-302
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
USE OF LESS REACTIVE MATERIALS AND MORE STABLE GASES TO REDUCE CORROSIVE WEAR WHEN LUBRICATING WITH HALOGENATED GASES. Donald H. Buckley and Robert L. Johnson. Aug. 1960. 19p. OTS.

The gases CF_2Cl-CF_2Cl, CF_2Cl_2, and CF_2Br-CF_2Br were used to lubricate metals, cermets, and ceramics. One of the criteria for determining the effectiveness of a reactive-gas-lubricated system is the stability of the halogen-containing gas molecule. Friction and wear studies were made with a hemisphere rider sliding in a circumferential path on the flat surface of a rotating disk. The specimens of metal alloys, cermets, and ceramics were run in an atmosphere of the various gases with a load of 1200 g, sliding velocities from 75 to 8000 ft/min, and temperatures from 75 to 1400°F. The gas CF_2Cl-CF_2Cl was found to be an effective lubricant for the cermet LT-1B (59.0 wt.% Cr, 19.0 wt.% Al_2O_3, 20.0 wt.% Mo, and 2.0 wt.% Ti) and the ceramic Al_2O_3 sliding on Stellite Star J (cobalt-base alloy) at temperatures to 1400°F. The bromine-containing gas CF_2Br-CF_2Br was found to give friction and wear values that can be considered to be in a region of effective boundary lubrication for the cermet K175B (nickel-bonded metal carbide) sliding on the metal Hastelloy R-235 (nickel-base alloy) at temperatures to 1200°F. (auth)

23206 NLCO-804
National Lead Co. of Ohio, Cincinnati.
PAPERS PRESENTED AT THE X-RAY PREFERRED ORIENTATION MEETING HELD AT NATIONAL LEAD COMPANY OF OHIO, NOVEMBER 9 AND 10, 1959.
Peter R. Morris, ed. July 15, 1960. 62p. Contract AT(30-1)-1156. OTS.

Six papers were presented at the meeting. Separate abstracts were prepared for each paper. (W.L.H.)

23207 NLCO-804(p.9-24)
Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.
A GENERALIZED GROWTH INDEX FORMALISM.
Edward F. Sturcken.

The measurable diffraction planes of U are few in number and have their poles asymmetrically distributed with respect to the "a" and "b" crystallographic axes. The growth index expression is affected by the degree of asymmetry in the set of planes used. This affect is referred to as "formalistic" to distinguish it from other deleterious affects such as result from the use of too few diffraction planes or poor experimental measurements. Another "formalistic" affect results from the normalization of GI in which the planes used for the calculation of $\Sigma TC_{(hkl)}\cos^2\beta_{(hkl)}$ were not all the same as those used to calculate $\Sigma TC_{(hkl)}\cos^2\alpha_{(hkl)}$. This normalization was used to obtain GI = 0 for random orientation and to obtain equal numbers of diffraction planes for evaluating $\Sigma TC_{(hkl)}\cos^2\beta_{(hkl)}$ and $\Sigma TC_{(hkl)}\cos^2\alpha_{(hkl)}$. A modified expression is reported for GI. (W.L.H.)

23208 NLCO-804(p.25-37)
Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.
A GROWTH MECHANISM BASED UPON LATTICE DISTORTION. John P. LeGeros.

An expression which has been developed to predict the growth of fuel elements during irradiation, using x-ray-diffraction data, is presented. A growth mechanism is assumed which is based upon lattice distortions caused by the presence of interstitial atoms in the alpha-uranium lattice. It is assumed that atoms in the grain boundaries and in transition zones between the parent and twinned portions of a grain have lower energy chemical bonds than have atoms of the crystal lattice (grain). When these three regions are irradiated with the same number of neutrons per unit volume, the net flow of atoms will be from the grain boundary and transition regions to the crystal lattice (grain), causing lattice distortion. When the expression is applied to the x-ray-diffraction measurements on fuel elements, the effect of grain size upon irradiation growth is found. (auth)

23209 NLCO-804(p.39-42)
Battelle Memorial Inst., Columbus, Ohio.
QUANTITATIVE ANALYSIS OF PREFERRED ORIENTATION BY X-RAY DIFFRACTION LINE INTENSITY MEASUREMENTS. Dale A. Vaughan.

Methods were investigated for determining the orientation of fabricated uranium, to aid in understanding its growth behavior under neutron irradiation or thermal cycling. The investigations have included x-ray-diffraction intensity measurements. (W.L.H.)

23210 NLCO-804(p.43-6)
Nuclear Metals, Inc., Concord, Mass.
THE EFFECT OF POLE DENSITY ON THE RATIO I_{020}/I_{040}. Robert B. Russell.

A discussion is presented of the effect of pole density on the ratio I_{020}/I_{040} on extruded uranium. (W.L.H.)

23211 NLCO-804(p.49-58)
Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.
DETERMINATION OF THEORETICAL DIFFRACTION INTENSITIES FOR ALPHA URANIUM. Edward F. Sturcken.

A more precise set of theoretical diffraction intensities was obtained for alpha uranium by a refinement of the original atomic position parameter, y, determined by B. E. Warren, and by including a value for the Debye-Waller temperature factor ($e^{-(B\sin^2\theta)/\lambda^2}$). The measurements were made on single crystals of uranium using diffractometric techniques to assure a constant absorption factor and precise intensity measurements. The value determined for the position parameter is y = 0.1025 ± 0.0002 and, for the temperature factor, B = 0.26. The temperature factor is approximate and represents an average for the a, b, and c crystallographic directions. Intensities calculated for twenty diffraction planes using these values differ by 12.8%, on the average, from those reported by Warren. The range of differences for the various diffraction planes is from −33.3 to + 10.2%. The major cause of these differences is the new position parameter, y = 0.1025 ± 0.0002, compared to Warren's original value, y = 0.105 ± 0.005. The temperature factor requires a smaller correction varying from 2 to 7% for the first 14 diffraction planes. (auth)

23212 NLCO-804(p.59-60)
National Lead Co. of Ohio, Cincinnati.
A STUDY OF COLD WORK EFFECTS ON GRINDING OF A SAMPLE SURFACE. Richard N. Thudium.

In order to examine a sample surface by x-ray diffraction for preferred orientations, it is necessary to remove all effects of cold work induced during grinding and machining. An alpha-rolled U sample was used. A removal of 0.005 inch of U was obtained by grinding with papers 60, 80, 120, 400, and 600 grit silicon carbide successively. Three electrolytic etch solutions were considered. The $H_2SO_4-H_3PO_4-$glycerine solution removed U metal fairly rapidly, but left an irregular sample surface. The ethyl alcohol$-H_3PO_4-$ethylene glycol removed U metal very slowly and left an irregular surface. The chromic-acetic acid solution removed the U metal very rapidly and left a mirror-like surface. (W.L.H.)

23213 NMI-4392
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the period March 1, 1959 through March 31, 1959. S. Isserow, D. F. Kaufman, W. J. Richmond, R. G. Jenkins, W. L. Larson, A. R. Lumbert, A. M. Huntress, and J. P. Pemsler. July 27, 1959.

22p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

No significant changes in dimensions or quality were noted after 200 thermal cycles of a Vallecitos prototype tube between 500 and 1000°C. Quantitative data have shown the unreliability of previous qualitative indications that one possible heat treatment for power tubes, namely, 800°C for ½ hour, could be carried out in a copper extrusion jacket. An attempt was made to form a joint between Zircaloy-2 and stainless steel by extrusion. With readily available equipment, scintillation counting gave less reliable results than radiography for core-end location in power tubes. Samples from two melts of Zr–0.6 wt.% Ni have shown poor corrosion resistance in 900°F steam; a similar alloy in another program has shown good corrosion behavior. The difference in behavior is attributed to the different processing history of the Zr used in each melt. (For preceding period see NMI-4386.). (W.L.H.)

23214 NMI-4397
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period August 1, 1959 through August 31, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, H. Green, A. M. Huntress, and W. B. Tuffin. Nov. 16, 1959. 17p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Processing of the three outwardly satisfactory tubes (51, 53, 54) from the five unalloyed tubes (50 to 54 incl.) in the set extruded has continued. Fabricability of reduced-scale tubes incorporating alloy cores of U–1.5 wt.% Mo and U–1 wt.% Si continues to look promising; additional tubes extruded with Mo alloy cores have demonstrated the feasibility of shortening core and tapers without affecting other desired qualities. On the basis of promising results obtained earlier with rods, a development program was recently started to develop extruded tubular joints of stainless steel to Zircaloy. (For preceding period see NMI-4396.). (W.L.H.)

23215 NMI-4398
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period September 1, 1959 through September 30, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, G. A. Henrikson, H. M. Green, P. D. Corzine, A. M. Huntress, and W. B. Tuffin. Nov. 30, 1959. 40p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Of the lot of five unalloyed U tubes in the set, only two were found suitable for irradiation testing, No. 53 and No. 54. In the program aimed at producing tubes with cores of alloys other than U–2 wt.% Zr, three full-size tubes were extruded. The lot consisted of two full-size tubes with individual cores of 1 wt.% Si and 1.5 wt.% Mo and a companion tandem tube with cores of each of these compositions provided for destructive examination. Heat treatment studies are being performed in the systems U–1.5 wt.% Mo and U–0.2 wt.% Al in an attempt to obtain desired metallographic structures. In the program aimed at finding a metastable beta-phase alloy for power reactor application, preliminary screening has eliminated all but the following compositions: U–0.3 wt.% Cr, U–0.4 wt.% Si–0.4 wt.% Al, U–0.4 wt.% Si–0.3 wt.% Cr, and U–0.3 wt.% Cr–0.3 wt.% Mo. An attempt was made to obtain U–2 wt.% Zr core material with high carbon content. An intensive program was carried out in the area of demonstrating the feasibility of recycling scrap in the process used for making castings for driver tubes. Promising results were obtained using a sawtooth billet preshape for the fabrication of stainless steel–Zircaloy tubular joints by tandem extrusion. (For preceding period see NMI-4397.). (W.L.H.)

23216 NMI-7221
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period October 1, 1959 through October 31, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, R. G. Jenkins, W. J. Richmond, H. M. Green, and W. B. Tuffin. Mar. 18, 1960. 27p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Post-extrusion processing of unalloyed U tube No. 54 terminated with its unexpected failure during autoclave testing. Four billets with unalloyed U cores are being prepared for extrusion as natural U prototypes in a program aimed at producing several tubes with 3% enriched cores for irradiation testing at Vallecitos. Individual experimental tubes with cores of U–1 wt.% Si and U–1.5 wt.% Mo are being processed for irradiation. In the program aimed at finding a metastable beta-phase alloy, heat treatment and aging studies were carried out on extruded, cast alloys of two compositions, 0.3 wt.% Cr and 0.3 wt.% Cr–0.3 wt.% Mo. Effort in the stainless steel–Zircaloy joint program was concentrated on fabrication of full-size joints. (For preceding period see NMI-4398.). (W.L.H.)

23217 NMI-7222
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period November 1, 1959 through November 30, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, H. M. Green, W. B. Tuffin, and R. G. Jenkins. June 23, 1960. 39p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Four Vallecitos prototype tubes of unalloyed U were extruded. Two full-size tubes with cores of U–1 wt.% Si and U–1.5 wt.% Mo, respectively, are being processed for irradiation testing to permit comparison of swelling behavior with that of U–2 wt.% Zr. The work on two Al alloys, U–0.2 wt.% Al and U–0.5 wt.% Al, is concentrating on suitable methods for grain refinement. Work on metastable beta-phase U alloy has progressed through the stage of extrusion and evaluation of rods of four promising compositions. Several 4-inch-diameter tubular stainless steel–Zircaloy joints were extruded. (For preceding period see NMI-7221.). (W.L.H.)

23218 NMI-7223
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period December 1, 1959 through December 31, 1959. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, A. M. Huntress, H. M. Green, W. B. Tuffin, and R. G. Jenkins. June 24, 1960. 44p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Two tubes with cores of 3% enriched, unalloyed U are being prepared for irradiation testing at VBWR. Post-extrusion processing of the two full-size tubes with experimental alloy cores was discontinued because of defects. Work in the program to find metastable beta-phase alloys of U was concentrated on four compositions: U–0.3 wt.% Cr, U–0.3 wt.% Cr–0.3 wt.% Mo, U–0.3 wt.% Cr–0.4 wt.% Si, and U–0.4 wt.% Si–0.4 wt.% Al. An intensive program of rod extrusion was carried out in an effort to define conditions for extrusion of tubular stainless steel–Zircaloy joints having adequate strength and corrosion resistance. (For preceding period see NMI-7222.). (W.L.H.)

23219 NMI-7224
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period January 1, 1960 through January 31, 1960. S. Isserow, D. F. Kaufman, W. L. Larson, W. J. Richmond, H. M. Green, W. B. Tuffin, and R. G. Jenkins. June 27, 1960. 37p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Autoradiographic evaluation of clad thickness completed the processing of the two tubes with cores of 3% enriched, unalloyed U prepared for irradiation testing at VBWR. In light of recent tube failures at SRP, the fabrication effort in the experimental tube program was reoriented. Preparation of full-size tubes with experimental cores was postponed, and the fabrication effort is being concentrated in three areas: preparation of full-size tubes with unalloyed U cores, preparation of Vallecitos-size tubes with cores of U–1 wt.% Si and U–1.5 wt.% Mo, and preparation of tubular specimens with a variety of core composition for irradiation in capsules at Savannah River. The program aimed at finding a metastable beta-phase alloy and developing fabrication of dilute Al alloys was suspended early in the month. A limited experimental program is being undertaken to determine out-of-pile creep behavior of U and selected U alloys. The cause of failure of Zircaloy-2-clad fuel elements in irradiation was not established but may be related to strain limitations in the fuel element. A program was initiated to evaluate, in out-of-pile tests, factors which might affect fuel element service life by limiting ductility of the element or its components. A mechanical burst test method was developed for testing strain limits of appropriate materials. Supplementary tests were run to determine the extent of hydrogen picked up by the cladding in processing steps involving bright etching and corrosion testing. Additional data concerning corrosion resistance and strength were obtained on extruded stainless steel–Zircaloy rods. A 2-inch-diameter tubular stainless steel–Zircaloy extrusion was subjected to hydrostatic burst testing. Progress in the program on cost reduction in Zircaloy etching is reported in several areas. (For preceding period see NMI-7223.). (W.L.H.)

23220 NMI-7226
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period March 1, 1960 through March 31, 1960. S. Isserow, D. F. Kaufman, W. J. Richmond, H. M. Green, and R. G. Jenkins. July 6, 1960. 34p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

A recent design change in the fuel element for the power reactor calls for replacement of the thick-walled tube with concentric tubes of thinner wall. Preparations are being made to extrude prototype outer tubes of the new design with alloy cores of 1.5 wt.% Mo and 1 wt.% Si. Out-of-pile creep tests are being performed on unalloyed U and U alloyed with 1.5 wt.% Mo to test the hypothesis that dimensional stability in irradiation may be a function of creep resistance. Testing of the effects of process variables on the ductility of tubular fuel elements has continued. The program on etching of Zircaloy is nearing completion. (W.L.H.)

23221 NMI-7228
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the period May 1, 1960 through May 31, 1960. S. Isserow, A. M. White, H. F. Sawyer, A. D. Donaldson, W. J. Richmond, H. M. Green, and W. B. Tuffin. July 12, 1960. 31p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

For the processing of alloyed VBWR prototype tubes, available Oy-3 was consolidated by arc-melting in an 8-inch mold. Room-temperature tensile tests showed that simulated thermal conditions of the corrosion acceptance test, when applied to beta-treated U, caused an increase in elongation of ~100%, an increase in ultimate tensile strength of ~30%, and a decrease in yield strength of less than 10%. For U–15 wt.% Mo there is evidence that the heat treatment results in a metastable structure which undergoes transformation during creep testing. The program to make stainless steel–Zircaloy joints was reactivated. (For preceding period see NMI-7227.) (W.L.H.)

23222 NMI-7229
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period June 1, 1960 through June 30, 1960. S. Isserow, A. M. White, H. F. Sawyer, A. D. Donaldson, W. L. Larson, W. J. Richmond, P. R. Smoot, H. M. Green, and W. B. Tuffin. Aug. 2, 1960. 34p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Development of fabrication techniques for the new thin-walled outer tubes has continued. Work was begun on the development of the coextruded inner tubes. Work was resumed on the program to produce tubular specimens for capsule irradiation. Additional creep and stress-rupture data were obtained for U–1.5 wt.% Mo alloy and for dingot U. (For preceding period see NMI-7228.) (W.L.H.)

23223 NMI-9502
Nuclear Metals, Inc., Concord, Mass.
BERYLLIUM RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period April 1, 1960 to June 30, 1960. S. H. Gelles. July 26, 1960. 25p. Contract AF33(616)-7065.

The objective of this program is to conduct a program, aimed at making beryllium useful as a structural material. There are three major categories in this program: (1) purification, (2) joining, and (3) flow and fracture. The philosophy behind these programs is twofold: first, to increase the usefulness of beryllium by advancing the technology of the material and by understanding the process and metallurgical factors involved in this technology; second, to improve present-day beryllium purification, working, heat treatment, and alloying. Within the three major categories are 12 projects, approximately 40% of which are to be carried out at NMI, the remaining 60% to be subcontracted. A list of these projects and the sites at which they will be carried out is given. (W.L.H.)

23224 NUMEC-TM-P-11
Nuclear Materials and Equipment Corp., Apollo, Penna.
DEPLETED VS NATURAL URANIUM IN Pu REACTORS. K. H. Puechl. May 2, 1960. 4p. OTS.

The relative merits of depleted and natural U as source materials in Pu-fueled reactors are discussed in terms of fuel costs. (W.L.H.)

23225 OOR-2060.4
Brown Univ., Providence.
AN EXPERIMENTAL DESIGN FOR VIBRATORY LIQUID SINTERING. Dogan E. Gücer. June 1960. 24p. DA Project DA-599-01-004. Contract DA-19-020-ORD-4888.

An experimental setup for measuring and controlling the vibrational energy input into a WC-Co liquid sintering specimen inside a high temperature hydrogen furnace is described. The control of input energy is achieved by proper acoustic design of the wave path and the measurement of dynamic strain amplitudes along this path. A method of calculation of the energy transmitted through the interface between the transmission bar and liquid sintering specimen and of the dynamic variables inside the specimen is proposed. The reproducibility of dynamical measurements and of alloy microstructures is discussed. (auth)

23226 ORNL-1729(Del.)
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 10, 1954. July 29, 1954. Decl. with deletions Nov. 12, 1959. 114p. Contract W-7405-eng-26. OTS.

Reactor Theory and Design. The main pump for the fuel system of the ARE was installed. The main sodium pump was also installed and the stand-by fuel and sodium pumps will be installed later. The fuel-to-helium and sodium-to-helium heat exchangers that had faulty welds were refabricated and reinstalled. The experimental reactor engineering program has included the development of components for in-pile loops, the design of forced-circulation corrosion-testing loops, and the construction of a unit for testing the mass-transfer characteristics of a sodium–beryllium–Inconel system. Further tests of bearing and shaft-seal materials were also made. Components of the proposed 60-Mw Circulating Fuel Reactor Experiment are being designed and constructed and are to be tested to determine operational characteristics. The intensive studies of the fluoride systems of interest as reactor fuels were continued with particular emphasis on systems in which the uranium-bearing component is the less corrosive UF_3 or a mixture of UF_3 and UF_4 rather than UF_4 alone. The static, seesaw and thermal-convection loop facilities were used extensively to further test the corrosion resistance of various materials in fluoride mixtures and in liquid metals. The effects of temperature and exposure time were investigated further, and additional confirmation of the relation of these variables to mass transfer in fluoride–Inconel systems was obtained. Reductions in depth of attack by UF_4-bearing fluoride mixtures, in comparison with the attack on standard Inconel, were found in loop constructed of Hastelloy B and of a special Inconel with a portion of the chromium replaced by molybdenum. The metallurgical research effort was devoted to studies of the mechanical properties of Inconel in contact with fluoride mixtures, to investigations of materials suitable for high-thermal-conductivity fins, to searches for container materials other than Inconel for fluoride mixtures, and to development of fabricational techniques. High-temperature oxidation tests of several brazing alloys have shown that the majority of the nickel–chromium–base alloys are suitable for service in an oxidizing atmosphere at 1500°F. The enthalpies and heat capacities of ARE fuel $NaF-ZrF_4-UF_4$ and of K_3CrF_6 were determined. Density and viscosity measurements were made for molten $RbF-LiF$, and thermal conductivities were measured for molten $RbF-LiF$ and solid $NaF-KF-LiF$. Electric conductivity measurements were made on molten NaOH. The radiation-damage program included additional irradiations in the MTR of fluoride mixtures in Inconel capsules, construction of in-pile loops, and development of creep-testing equipment for use in the MTR. The analytical studies of reactor materials included the problems of separating UF_3 from UF_4 in $NaZrF_5$-base fuels and fuel solvents, the formulation of a method for determining oxygen in these mixtures, stability tests of trivalent uranium in HCl solutions, and petrographic examination of ZrF_4-base fuels. (W.L.H.)

23227 ORNL-2935
Oak Ridge National Lab., Tenn.
FISSION-PRODUCT RELEASE FROM UO_2. W. B. Cottrell, H. N. Culver, J. L. Scott, and M. M. Yarosh. Sept. 13, 1960. 140p. Contract W-7405-eng-26. OTS.

The information available, as of the fall of 1959, on the release of fission products from UO_2 was studied and correlated in order to present a comprehensive and consistent interpretation of the experimental data. A discussion of the mechanism for fission-gas release, the analytical model for predicting release, the model limitations, and the parameters affecting release are included. These considerations are necessary for the prediction of the total pressure buildup in a clad UO_2 fuel element and the prediction of the activity release from a defective or unclad UO_2 fuel element. The fuel-irradiation program of the Oak Ridge National Laboratory is reviewed, and a number of parametric studies bearing on the performance of the fuel element for the Experimental Gas-Cooled Reactor are described. For this report the emphasis was placed on fuel elements operated at higher surface temperatures and lower external pressures than those for pressurized-water systems. Most of the experimental data were obtained for pressurized-water systems, however, and the analytical extrapolations of these data to other conditions remain to be verified experimentally. (auth)

23228 JPRS-2920
PRODUCTION AND PHYSICAL METALLURGY OF PURE METALS. PART I. V. S. Emel'yanov (Yemel'yanov), A. I. Evstyukhin (Yevstukhin), and G. A. Leont'ev (Leont'yev). Translated from Met. i Metalloved. Chistykh Metallov No. 1, 5-43(1959). 48p. OTS.

Design and operation of an electrolyzer is described in two chapters under the titles Investigation of the Electrolytic Production of Thorium and Design of an Electrolyzer with Automatic Compacting Cathodes for Electrolysis of Fused Thorium Salts. Results of thorium electrolytic separation from $NaCl-KCl-ThF_4$ system are given, and the mechanics of the process are examined. (J.R.D.)

23229 JPRS-5145
PRODUCTION AND PHYSICAL METALLURGY OF PURE METALS—PART III. V. S. Emel'yanov (Yemel'yanov), P. D. Bystrov, A. I. Evstyukhin (Yevstyukhin), G. A. Leont'ev (Leont'yev), I. P. Barinov, D. D. Abanin, and A. A. Bakakina. Translated from Met. i Metalloved. Chistykh Metallov., No. 1, 63-90(1959). 36p. OTS.

Methods for production of pure metals such as hafnium, molybdenum, and zirconium, and regeneration of zirconium and iodine in the iodide process are described. Separate abstracts were prepared for each of the four papers included. (J.R.D.)

23230 JPRS-5145(p.1-9)
PRODUCTION OF DUCTILE HAFNIUM BY THE IODIDE METHOD. V. S. Emel'yanov (Yemel'yanov), P. D. Bystrov, and A. I. Evstyukhin (Yevstyukhin). Translated from Met. i Metalloved. Chistykh Metallov., No. 1, 63-9(1959).

A detailed study of hafnium refining is described. It was found that the dependence of the hafnium deposition rate on the temperature of the initial metal and on the pressure in the flask coincides with an analogous dependence for zirconium. Filament temperature also affects each similarly. It is concluded that no substantial separation of zirconium from hafnium takes place during the iodide process. (J.R.D.)

23231 JPRS-5145(p.10-20)
INVESTIGATION OF THE PROCESS OF OBTAINING DUCTILE MOLYBDENUM BY THE THERMAL DISSOCIATION OF ITS PENTACHLORIDE. G. A. Leont'ev (Leont'yev). Translated from Met. i Metalloved. Chistykh Metallov., No. 1, 70-7(1959).

Production of ductile molybdenum by thermal dissociation of $MoCl_5$ is described. In the absence of air, tungsten or molybdenum wire is heated at 1300 to 1400°C in $MoCl_5$ vapor. Thermal dissociation of the $MoCl_5$ takes place and molybdenum is deposited on the filament. The liberated chlorine reacts again with new molybdenum introduced into the reactor for refining. (J.R.D.)

23232 JPRS-5145(p.21-7)
INVESTIGATION OF THE IODIDE PROCESS FOR PRODUCING ZIRCONIUM, EMPLOYING ZIRCONIUM CARBIDE AS RAW MATERIAL. A. I. Evstyukhin (Yevstuyukhin), I. P. Barinov, and D. D. Abanin. Translated from Met. i Metalloved. Chistykh Metallov., No. 1, 78-83(1959).

Preparation of zirconium from ZrC is described. A laboratory device was designed in which iodine can be reacted with ZrC to produce ZrI_4 in almost theoretical yield. Iodide zirconium can then be prepared by dissociation of the ZrI_4. (J.R.D.)

23233 JPRS-5145(p.28-35)
CONCERNING THE METHOD OF REGENERATION OF ZIRCONIUM AND IODINE IN THE IODIDE REFINING PROCESS. A. I. Evstyukhin (Yevstyukhin) and A. A. Bakakina. Translated from Met. i Metalloved. Chistykh Metallov., No. 1, 84-90(1959).

23234 UCRL-Trans-504(L)
CONCERNING THE CRYSTALLIZATION OF EVAPORATED ANTIMONY FILMS. Adolf Götzberger. Translated by Esther Fultz from Z. Physik 142, 182-200(1955). 24p. JCL.

The conditions of formation and the mechanism of various crystallization phenomena are reported for crystallization of vacuum evaporated antimony films. Antimony precipitates out of the vapor phase in a relatively stable nonmetallic modification. The behavior of such a film depends upon the film thickness. (auth)

23235
PHYSICAL-CHEMICAL BASIS FOR TITANIUM METALLURGY. O. Kubaschewski (National Physical Lab., Teddington, Middx, Eng.). Angew Chem. 72, 255-63(1960) Apr. 21. (In German)

The technical processes used at present for the recovery of titanium were outlined and the thermochemical data of the titanium halogenides and of the system titanium—oxygen were surveyed and newly evaluated, and possible approaches to titanium production and raffination on the basis of these data were discussed. The available thermochemical data of nitride, carbide, and alloy formation were summarized, and the mechanism of electrolytic titanium recovery from solutions of K_2TiF_6 in alkali chloride melts and kinetic observations were discussed. (auth)

23236
URANIUM DIOXIDE FUEL ELEMENTS FOR NUCLEAR REACTORS. L. M. Wyatt. Brit. Power Eng. 1, No. 3, 26-32(1960) Aug.

The advantages and disadvantages of UO_2 as a fuel-element material were studied. UO_2 showed greater compatibility with H_2O, H_2, and CO_2 than uranium metal; the melting point was higher, and the dimensional stability was greater than the pure metal. It is also cheaper than the metal. Some disadvantages in using UO_2 were found to be its lower density and low thermal conductivity. A study of its modulus of rupture and thermal expansion also indicated that the rods would crack if their heat output exceeded 25 watts/cm. Because of probable cracking the UO_2 was formed into pellets instead of rods for canning. Three types of canning material are used; these are stainless steel, zirconium, and beryllium. The advantages and disadvantages of each material were investigated. The difficulty of using long lengths of this brittle material for fuel elements resulted in the use of bundles of rods connected together. (M.C.G.)

23237
ULTRAHIGH PRESSURE TECHNOLOGY. Charles M. Schwartz (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. Progr. 56, No. 8, 71-6(1960) Aug.

A general discussion is presented on the current status and possible applications of high-pressure research. High-pressure apparatuses are discussed at length, including those of P. W. Bridgman and the tetrahedral anvil used for the synthesis of diamond and Borazon. A new "girdle" die design was presented for use at high pressures and high temperatures; it has reached pressures of over 1.3×10^5 atm in preliminary tests. The applications of pressure were treated with reference to the synthesis and the properties of substances. A new form of sodium silicate, coesite, was prepared along with a number of naturally occurring minerals. Applications of pressure in the synthesis of reactor materials and fuel elements were considered. It was found that UO_2, which is unstable at high temperatures in an oxidizing atmosphere, could be transformed into a stable material for reactor use as a ceramic body by incorporating Sc_2O_3 in it under pressure. A new modification of U_3O_8 was obtained under pressure. The effects of pressure on properties, e.g., conductivity, x-ray diffraction, and nuclear magnetic resonance were discussed, and it was concluded that much more data were needed on this topic for a better understanding of the nature of the solid state. (D.L.C.)

23238
MEASUREMENT OF THE THERMAL DIFFUSIVITY OF SOLIDS. Louis Sicard, Lucien Eyraud, Gustave Malécot, Jean Elston, and Charles Eyraud (Faculté des Sciences, Lyon). Compt. rend. 248, 2970-2(1959) May 25. (In French)

The methods of sinusoidal thermal attack on a solid involve conditions with fairly strict limits which can be calculated and respected in practice. To extend the problem to thermal shocks demands an analysis of the phenomenon at frequencies and temperatures as high as possible. (auth)

23239
CONTROL OF INTERMETALLIC PARTICLES IN MAGNESIUM ALLOYS BY FILTRATION. W. Unsworth (Magnesium Elektron, Ltd., [Manchester, Eng.]). Metallurgia 62, 15-20 (1960) July.

Insoluble intermetallic particles in wrought magnesium alloys can be controlled by a filtration process in which the molten metal is passed in a downward direction through a suitable filter bed maintained below the filtered metal level to prevent oxidation. No. 8 grade chilled iron shot appears to be the most practically satisfactory filter material. (auth)

23240
ACCIDENTAL CLUSTERS IN DISORGANISED SOLID SOLUTIONS. P. G. de Gennes, P. Lafore, and J. P. Millot (Centre d'Études Nucléaires, Saclay, France). Phys. and Chem. Solids 11, 105-10(1959). (In French)

Propagation phenomena in binary solid solutions AB were considered with the wave being carried by A atoms only. Such situations were encountered in impurity bands for semi-conductors and in spin waves in alloys with one ferromagnetic component. It was found that below a critical percentage, depending on the range of the couplings, the A atoms always belong to finite "clusters" (different clusters being unlinked by the wave equation). The eigenvalues spectrum of the wave equation is then discrete. Above the critical percentage, both finite and non-finite clusters are found. The eigenvalue spectrum therefore has a continuous component. A finite static conductivity may occur. (auth)

Corrosion

23241 BMI-1457
Battelle Memorial Inst., Columbus, Ohio.
CREEP AND CORROSION PROPERTIES OF ZIRCALOY-2 IN STEAM AT 750 F. Edward J. Jablonowski and Frederic R. Shober. Aug. 1, 1960. 22p. Contract W-7405-eng-92. OTS.

Test equipment to determine the creep properties of Zircaloy-2 in a 750°F 500-psi steam atmosphere was designed and constructed. Duplicate tests were performed at stresses to produce failure in approximately 1, 10, 100, and 1000 hr. A comparison between these data and data obtained in vacuum-test equipment showed that a corrosive test atmosphere does not alter ductility or failure times appreciably. (auth)

23242 DMIC-Memo-60
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
STRESS-CORROSION CRACKING OF Ti−5Al−2.5Sn. Hiram Brown. Aug. 4, 1960. 11p. (PB 161210). OTS.

Tests were conducted in which Ti−5Al−2.5Sn alloy was heated to 1150 to 1500°F in the presence of shop-processing materials such as trichloroethylene, air, HF, HNO_3−HF solutions, and cutting oil. It was concluded that stress corrosion cracking of this alloy takes place in the presence of halides and oxygen during heat treatment. (J.R.D.)

23243 GNEC-121
General Nuclear Engineering Corp., Dunedin, Fla.
STUDIES ON THE COMPATIBILITY OF HIGH-TEMPERATURE CARBON DIOXIDE WITH STAINLESS STEELS AND OTHER MATERIALS. Preliminary Report. Dec. 17, 1959. 29p. OTS.

The compatibility of CO_2 with various stainless steels, aluminum−chromium−iron alloys, chromium, steel, carbon steel, and nickel alloys was studied at 1050 to 1500°F. The effects of temperature, pressure, gas velocity, solution annealing, and water vapor in Co_2 on the corrosion rates of the above alloys and stainless steels were studied. (C.J.G.)

23244 HW-56515
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HYDROGEN ABSORPTION IN ZIRCALOY-2 DUE TO AQUEOUS CORROSION AT 680°F. Daryl L. Gray. June 19, 1958. 8p. Contract AT(45-1)-1350. OTS.

Previously published data on corrosion rates and hydrogen absorption in zirconium and zirconium alloys in water at 680°F are reviewed. From these data, calculations were made which show that hydrogen concentrations in Zircaloy-2 are possibly due to hydrogen absorption during the corrosion reaction. (C.J.G.)

23245 HW-65077
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ALUMINUM ALLOY WORK AT HANFORD. Interim Report. H. C. Bowen. May 6, 1960. 17p. Contract AT(45-1)-1350. OTS.

Aqueous and steam corrosion of aluminum at elevated temperatures was investigated. Aluminum−iron−nickel alloys were consistently fabricated which showed corrosion penetration as low as 0.3 mils after 6 months exposure in 360°C water. These alloys, made from a wide range of iron and nickel contents in low-silicon aluminum, were no better than X-8001 (1% Ni, 0.5% Fe) at testing temperatures below 320°C. The low-silicon alloys were much less susceptible to heat-treating damage than X-8001, however. (M.C.G.)

23246 KAPL-2000-10(p.A.7-A.11)
Knolls Atomic Power Lab., Schenectady, N. Y.
WEAR OF ZIRCALOY-BEARING SURFACES OF A CONTROL ROD. L. R. Bollinger.

During the course of flow-testing of a unit cell, severe wear developed between the rubbing surfaces of the control rod and the fuel-supporting tube structure. Causes of the high wear were investigated in a series of tests. Results are discussed. (W.D.M.)

23247 KAPL-2000-10(p.E.16-E.21)
Knolls Atomic Power Lab., Schenectady, N. Y.
USE OF GAMMA-RAY SPECTROMETRY FOR ESTIMATING PRIMARY SYSTEM CORROSION RATES AND RADIOCHEMICAL CRUD BUILDUP. R. L. Seidel.

A nondestructive radiochemical method is proposed by which the amount and nature of the deposits on any reactor primary system component can be determined. The method has the advantage that short-lived deposited nuclides can be studied as well as the long-lived nuclides. Additional information such as system corrosion rates and crud distribution in the primary system can be estimated from the data. (W.D.M.)

23248 NAA-SR-Memo-4847
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
ZIRCONIUM CORROSION IN POLYPHENYLS: A LITERATURE SURVEY. F. L. Cochran. Jan. 11, 1960. 27p. OTS.

A literature survey was made for research performed on zirconium corrosion in polyphenyls. The corrosion of zirconium and its alloys was evaluated on the basis of weight change, changes in bend ductility, and metallographic examination of the exposed specimen. Differences in data reportedly obtained under similar conditions were pointed out. The polyphenyls at reactor operating conditions may undergo decomposition and release hydrogen. Weight gains of zirconium specimens exposed to organic coolant indicated hydrogen gettering, and continued absorption of hydrogen led to embrittlement. Generally, the literature indicated zirconium was unsatisfactory in organic cooled reactors because of its tendency to become oxidized and/or hydrided. (M.C.G.)

23249 NLCO-554
National Lead Co. of Ohio, Cincinnati.
COCOA REACTOR CORROSION STUDIES—A PRELIMINARY REPORT ON PHASE 2. (EVALUATION OF SULFUR CORROSION ATTACK IN PLANT 4). F. H. Meyer, Jr. May 16, 1955. Decl. Mar. 16, 1960. 10p. Contract AT (30-1)-1156. OTS.

A three-phase evaluation program has been undertaken to determine whether the use of sulfated orange oxide is detrimental to processing equipment. Phase 2 of this program had the objective of determining, quantitatively, the amount of corrosion occurring on presently used and proposed materials of construction during operations. Type 316, type 304, and type 309 Cb stainless steel proved to be suitable materials of construction, but Hastelloy C alloy and Inconel alloy proved to be unsuitable. (auth)

23250
SELECTIVE REMOVAL OF CHROMIUM FROM TYPE 304 STAINLESS STEEL BY AIR-CONTAMINATED LITHIUM. R. E. Seebold, L. S. Birks, and E. J. Brooks (Naval Research Lab., Washington, D. C.). Corrosion 16, 468t-70t (1960) Sept.

The corrosive action of high-purity and air-contaminated lithium on Type 304 stainless steel was studied in nonisothermal closed systems in which maximum and minimum temperatures were 1500 and 800°F. Chromium is selectively removed to depths of 10 microns from the surface of stainless steel by air-contaminated lithium at 1500°F and remains dissolved in the lithium where it is soluble to the extent of at least 25 %. The other steel constituents are mass transferred in their original relative proportions and deposited as strongly magnetic dendrites. The preferential leaching of chromium is proposed as the initial step in the corrosion of stainless steel by air-contaminated lithium. (auth)

23251
THE HIGH-TEMPERATURE AQUEOUS CORROSION RESISTANCE OF THE URANIUM-5% ZIRCONIUM-1 1/2% NIOBIUM ALLOY. J. E. Draley, S. Greenberg, and W. E. Ruther (Argonne National Lab., Ill.). J. Electrochem. Soc. 107, 732-40(1960) Sept.

The U-5% Zr-1$\frac{1}{2}$% Nb alloy showed good corrosion resistance, as gamma quenched, in water to about 315°C. Optimum heat treatment resulted in a rate of about 6 mg/cm^2/day at 290°C. Moderate aging, e.g., 400°C for 2 hr, resulted in reduced corrosion rates in the initial stages of corrosion; however, corrosion resistance could be destroyed by overaging. After protracted exposure, samples failed. This was believed due to absorbed corrosion product hydrogen. (auth)

23252
IDENTIFICATION OF THE DIFFUSING SPECIES IN URANIUM OXIDATION. J. G. Schnizlein, J. D. Woods, J. D. Bingle, and R. C. Vogel (Argonne National Lab., Ill.). J. Electrochem. Soc. 107, 783-5(1960) Sept.

Marker experiments were carried out to determine whether uranium or oxygen diffused through the oxide film during oxidation reactions at 200°C in 200 mm of oxygen. In one method, metallographic examination was used to establish whether an inert marker would become buried in the oxide and if two impinging oxide films would fuse together. The second method used involved an α-counting technique to locate a marker of enriched uranium. Each of the experiments demonstrated conclusively that oxygen, rather than uranium, diffused through the oxide layer during oxidation. (M.C.G.)

23253
REACTIONS BETWEEN STEEL SURFACES AND ZIRCONIUM IN LIQUID BISMUTH. John R. Weeks and Carl J. Klamut (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 8, 133-47(1960) Aug.

The variables affecting corrosion and mass transfer of steels by inhibited liquid Bi are discussed and explained in terms of the variables affecting formation of the ZrN or ZrC inhibiting films. Corrosion is acclerated by increasing the maximum temperature of operation, the temperature differential, and the Cr content of the steel. Low carbon areas also are more sensitive to attack, as are rough surfaces. Segregation in weld areas and their normally low C content may be responsible for preferential weld attack. Formation of the inhibiting nitride and/or carbide films is controlled by the activity and distribution of N and C in the steel. Minor constituents that influence their activity and distribution may also therefore affect the corrosion resistance. Localized attack is accompanied by Zr deposition, possibly resulting from interaction between the dissolved Zr and carbide particles in the steel. ZrN films may spall, and can reform in the spalled and corroded areas. (auth)

Fabrication

23254 CF-58-7-138
Oak Ridge National Lab., Tenn.
M-25, BUTT WELDS IN PROCESS PIPING. A. P. Litman. July 10, 1958. 8p. OTS.

Metal-arc and inert-gas shielded tungsten-arc processes were compared for circumferential butt welding of austenitic stainless steel process pipe. Inert-gas tungsten-arc welding was superior to other techniques. (C.J.G.)

23255 DMIC-Memo-58
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
TURNING OF HIGH-STRENGTH STEELS IN THE HARDNESS RANGE OF 330 TO 560 BRINELL. C. T. Olofson. July 15, 1960. 46p. (PB-161208). OTS.

A summary of information and data on cutting conditions used in turning high-strength steels at hardness levels between 330 and 560 Brinell is presented. 34 references. (J.R.D.)

23256 DMIC-Memo-61
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
SELECTED REFERENCES TO ASTIA DOCUMENTS ON MACHINING. F. W. Boulger and M. B. Gold. Aug. 11, 1960. 49p. (PB-161211). OTS.

A bibliography is presented on the machining of high-strength heat-resistant metals. The references are grouped under the following headings: machining practices, tool materials, machining properties, program-controlled tools, alternate methods of machining, machine tools, metal-cutting phenomena, cutting fluids, automated processes, and miscellaneous. (W.L.H.)

23257 HW-64252
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
WELD ALLOYING IMPROVEMENT WITH SQUARE TYPE CURRENT WAVES ON ALTERNATING-CURRENT TUNGSTEN-ARC INERT-GAS-SHIELDED WELDING. T. B. Correy. May 23, 1960. 76p. Contract AT(45-1)-1350. OTS.

The improvement of fusion weld alloying with square type current waves in the closure weld of AlSi-bonded aluminum-clad uranium fuel elements was established. Alloying improved as the current wave shape changes from an asymmetrical 180° out-of-phase third-harmonic distorted sine wave toward a symmetrical square wave. It was demonstrated that there is a positive agreement between the ratio of the power pulse with the electrode positive to the power pulse with the electrode negative and the weld quality number showing that alloying in the weld improves as the current wave shape changes toward a square wave. It is shown that weld alloying can be measured by a number. The area covered by the arc on the plane of any finite point to plane setup was found to be directly proportional to the current. From the test results it was found that weld alloying improves as the temperature in the weld is held more constant and concentrated by a more constant value of current in each pulse. The relation between welding speed, shielding-gas ratios, and the open-circuit voltage required to produce a stable arc without the use of high-frequency stabilization was demonstrated. It was shown that the use of a superimposed high-frequency current will contribute to an unstable arc condition with open-circuit voltages that will produce a stable arc. (auth)

23258 HW-64762
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRTR CALANDRIA FABRICATION REPORT. L. T. Pedersen and M. R. Kreiter. July 12, 1960. 42p. Contract AT(45-1)-1350. OTS.

Fabrication problems encountered during construction of the PRTR Calandria were primarily concerned with welding. These problems included: inability to qualify welders on the initial filler material specified, excessive porosity, distortion, and leaks. Careful attention to cleaning, joint preparation, and weld technique was only successful in reducing the number of repairs from 40 to 20 per cent. Exacting tolerances required the design, fabrication, and operation of special portable tools due to the lack of suitable large equipment at Hanford. Each shroud tube was inspected optically while the completed calandria was positioned relative to the reactor top and bottom shields. Eighty-seven per cent of the tubes deviated less than 0.060 inch, and all were within 0.073 inch of a reference line established between the hole centers in the shields. (auth)

23259 KAPL-2000-10(p.F.28-F.32)
Knolls Atomic Power Lab., Schenectady, N. Y.
MANUFACTURING DESIGN AND FEASIBILITY CONSIDERATIONS FOR JOINING MATERIALS TO FORM RECTANGULAR TEST SECTIONS. E. J. Petroski and T. B. Smith.

Very thin material was successfully welded to thick material to form rectangular stainless steel engineering test sections to simulate channel openings in plate-type fuel assemblies. The simulated channel openings varied from 0.060 to 0.250 in. and the test sections ranged in length from 12 to 27 in. Low heat inputs were required to minimize distortion. (W.D.M.)

23260 LMSD-703045
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
HIGH-IMPACT METAL FORMING, 1957–1960. An Annotated Bibliography. A. A. Beltran, comp. July 1960. 40p. (SB-60-25). OTS.

A bibliography on explosive forming of metals is presented. Reports of hydrospark forming, electro-discharge machining, impact extruding, and insertion of bolts into metals by shooting are also included. Information sources include ASTIA card catalog; catalogs of Lockheed's information center; Aero/Space Engineering; Battelle Memorial Institute, DMIC, Memo 51, 7 April 1960 and Selected Accessions; Battelle Technical Review; Crerar Metals Abstracts; Engineering Index; American Society for Metals, Review of Metal Literature; and ASTIA, Technical Abstract Bulletin. 130 references. (J.R.D.)

23261 MAB-165-M
National Research Council. Materials Advisory Board.
DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). Report of Proceedings, Invitational Meeting, Panel on Rolling, Cold Forming, and Cold Extrusion, December 8, 9, 10, 1959. May 31, 1960. 500p. Contract DA-36-039-sc-76436.

Abstracts were prepared for 4 of 19 papers pertaining to the requirements and use of flat rolled products for aero-space systems. (C.J.G.)

23262 MAB-165-M(p.71-99)
National Research Council. Materials Advisory Board.
REVIEW OF PROBLEMS IN USING FLAT ROLLED MATERIALS IN AIR AND SPACE WEAPON SYSTEMS. F. W. Boulger.

The problems of joining, forming, and heat treating Ti alloys, steels, and refractory metals to obtain the desired properties for use at very high temperatures are reviewed. (C.J.G.)

23263 MAB-165-M(p.200-38)
National Research Council. Materials Advisory Board.
A REVIEW OF THE STATUS OF THE REFRACTORY METALS AND BERYLLIUM FROM THE PRODUCER'S STANDPOINT. A. V. Levy.

The uses, ease of fabrication, and properties of Nb, Mo, Ta, W, and Be are reviewed relative to aero-space applications. (C.J.G.)

23264 MAB-165-M(p.404-38)
National Research Council. Materials Advisory Board.
CURRENT DEVELOPMENTS AND ADDITIONAL DEVELOPMENT EFFORT REQUIRED TO MAKE AVAILABLE FLAT-ROLLED REFRACTORY METALS AND ALLOYS. P. C. Rossin.

The future requirements of refractory materials for high-temperature applications are discussed. Techniques of fabricating refractory metals and alloys are discussed. A facility (InFab) in which refractory materials can be fabricated at their true hot-working temperatures in inert atmospheres is described relative to the Ar purification system, the impactor (a forging device), lab enclosure, and the consumable-electrode vacuum arc-melting furnace. An impervious clothing assembly for personnel who must work in the inert-atmosphere area is described. (C.J.G.)

23265 MAB-165-M(p.439-56)
National Research Council. Materials Advisory Board.
FLAT ROLLED PRODUCTS IN THE NEW NONFERROUS METALS AND ALLOYS (EXCEPT MOLYBDENUM, COLUMBIUM, TANTALUM, AND TUNGSTEN). William H. Santschi.

The commercial purification process for Be is described. The fabrication and properties of sheet Be are discussed. (C.J.G.)

23266 NMI-1133
Nuclear Metals, Inc., Cambridge, Mass.
ATOMIC POWER DEVELOPMENT ASSOCIATES PROGRESS REPORT [FOR] JULY 1, 1954–JANUARY 31, 1955. R. Evans, L. Minnick, A. Boltax, and E. Rapperport. Apr. 4, 1955. Decl. Feb. 4, 1960. 25p. Contract AT (30-1)-1565. OTS.

Fabrication techniques for several types of fuel elements were investigated. The main effort was directed toward casting a radiator type element using 0.165 in. OD tubing spaced 0.195 in. on centers. The U-Cr eutectic alloy (m.p. 859° ± 10°C) was used against iron tubing which had been steam oxidized to give an adherent black iron oxide coating approximately 1 mil thick. Several casting and spacing techniques were evaluated and a 24 in. long element of 91 tube cross section having no outside ligament was cast, and 85%+ of the fuel ligaments were found to be within tolerance. Using the U-ZR (2% zirconium) against zirconium tubes in order to form a metallurgical bond, short 3 and 6 in. elements using the same tube size and spacing were cast. The effort in this program was to provide a good, sound, uniform bond, and to evaluate and identify the bonding mechanism. No effort was made to provide spacing in these castings other than at each end. Several U-Cr plates were cast 0.040 in. thick, 3.5 in. wide, and 28 in. long after several methods had been evaluated. A method to forge corrugated flat plates was developed using the U-Cr alloy. These plates would be assembled into an element similar to the radiator. The design and construction of a continuous casting device has been undertaken to make the remote fabrication of radiator elements easier and to provide another type of spacing mechanism. (auth)

23267 NMI-7227
Nuclear Metals, Inc., Concord, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period April 1, 1960 through April 30, 1960. S. Isserow, A. M. White, H. F. Sawyer, A. D. Donaldson, W. J. Richmond, H. M. Green, and R. G. Jenkins. July 11, 1960. 36p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Following the extrusion of two tubes having different experimental end shapes, three prototype outer tubes (designated as 74, 75, and 76) of the new thin-walled design were produced. Tube 74 is being processed for flow testing at Savannah River. Tube 75 will be evaluated as an irradiation candidate after it is heat treated. Tube 76, which has a shorter core, will be autoradiographed and destructively examined. A development program was initiated to obtain basic data for assistance in the design of billets for coextrusion. During the preparation of two thin-walled prototype VBWR tubes, one with an as-cast U-1.5 wt.% Mo core and the other with an epsilonized U-1 wt.% Si core, the casting operation was investigated to evolve an economical process. Additional tensile, creep, and stress-rupture data were obtained on unalloyed U and on U-1.5 wt.% Mo alloy to provide data for comparison with irradiation behavior. The study of the effects of processing variables on ductility has essentially been completed. The investigation to reduce the cost of the procedure for etching zircaloy was completed. (For preceding period see NMI-7226.) (W.L.H.)

23268 NP-8866
Chromalloy Corp., White Plains, N. Y.
EXPLOSIVE FORMING OF REFRACTORY METALS. Bi-Monthly Report No. 4 [for] December 31, 1959 through February 28, 1960. Mar. 1, 1960. 30p. Contract NOas 59-6265-c.

A photogrid method was successfully employed which permitted detailed study of the elongation pattern and the amount in explosively formed samples. Elongations up to ~30% were observed. Metallographic examinations and microhardness studies were made on a number of explosively formed test squares of Mo and Mo–Ti alloys. The results indicated normal cold worked structures in the Mo, normal hardness equivalents with no local anomalies, and equivalent RC30 hardness. (See also AD-231924.). (C.J.G.)

23269 JPRS-4000
INNOVATION IN POWDER METALLURGY. Z. Ministr. Translated from Vestnik Mashinostroeniya 40, No. 3, 80-1 (1960). 3p. OTS.

The use of powder metallurgy in production of machine parts which are characterized by superiority in mechanical properties is summarized. Examples such as the effects of phosphorus addition to iron, aluminum oxide addition to aluminum, fabrication of powdered magnesium alloy trusses, and others are given. (J.R.D.)

23270 NP-tr-465
NEW METHOD OF MANUFACTURING PIPES AND RODS FROM POWDERS OF HIGH-MELTING METALS AND THEIR COMPOUNDS. G. V. Samsonov and P. S. Kislyi. Translated from Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 46-8(1959). 6p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 13597.

23271
CONTRIBUTION TO THE PRODUCTION OF EVEN URANIUM LAYERS WITH DEFINITE URANIUM CONTENT ON ALUMINUM. W. Gebauhr and J. Martin (Siemens-Schuckertwerke A. G., Erlangen, Ger.). Atompraxis 6, 253-4(1960). (In German)

Cementation was used for producing even and adhesive uranium layers up to a thickness of 12 mg/cm^2 on aluminum. Directions for this technique are given. The necessary determination of the exact uranium content of such preparations is made by means of cerimetric titration of the remnant in the solution after reduction to U(IV). (auth)

23272
EFFECTS OF BETA-RAY IRRADIATION ON MITOSIS IN TRADESCANTIA WITH REFERENCE TO DOSAGE ESTIMATION. Hiraku Takebe (Tokyo Univ.). Cytologia(Tokyo) 25, 132-43(1960) Mar. (In English)

Compared with the effect of high-intensity x rays, P^{32} treatment was about $\frac{1}{3}$ or $\frac{1}{4}$ less effective in inducing chromosome aberrations. This was observed not only in the case of pollen mitosis, but also in root tip cell division. The decrease of effectiveness might be caused by the low intensity of irradiation. The dosage of beta rays was calculated in terms of r units, with the equations being based on the number of ion pairs produced per disintegration. (auth)

23273
FABRICATION-METHOD OF TANTALUM- AND NIOBIUM-METALS BY SINTERING, AND ITS APPLICATIONS. Toyoji Ishiyama and Tadashi Kuroda. Denki Shikensho Ihô 24, 471-3(1960). (In Japanese)

Sintering and fabrication are discussed for producing massive ductile tantalum and niobium from the powdered metals using high-vacuum techniques based on powder metallurgy. Some of the important applications of these metals are summarized. (auth)

23274
SHAPING OF URANIUM. J. A. Stohr (Commissariat à l'Énergie Atomique, Saclay, France). Métaux (Corrosion-Inds.) No. 403, 18p. (1959) May. (In French)

The choice of a method for shaping metal is especially important in the case of uranium. In effect the quantity of actual metal necessary to produce a given quantity of useful metal varies a great deal according to the method of shaping chosen. Scraps left over from the manufacture must as a general rule be converted to oxide and then to fluoride, which will be reduced by the thermit process using calcium or magnesium. This operation costs about 10,000 francs per kilogram of uranium metal. It is easy to see therefore the importance, from an economic point of view, of the means of transformation employed. The shaping process plays a very large part in the final morphology of the metal, whether it is used just as it is after fashioning or whether the transformation process is followed by appropriate heat and tempering treatments. This introduces a new factor from the economic point of view. This factor concerns the smallest number possible of treatments necessary and the resistance of the metal to irradiation. This account describes methods of shaping by casting under vacuum, γ drawing, α drawing, and α rolling. (auth)

23275

DECANNING FUEL ELEMENTS FROM MARCOULE. G. Deleuze (Société des Forges et Ateliers, Le Creusot, France), G. Petillat, and R. Guilloteau. Nuclear Power 5, No. 52, 98-9(1960) Aug.

A description is given of the underwater fuel element decanning plant at Marcoule. The decanning operation has much in common with continuous production processes, and it is carried out entirely mechanically. The decanning is carried out in two stages. These are preliminary slitting along two diametrically opposite longitudinal lines and extrusion of the uranium bar through a die. The motive fluid of the hydraulic power supply system is demineralized water with about 5% by volume of pure glycerine. The water is used because, if there were an escape of oil, drops carrying contaminants in suspension might rise to the surface, and the oil would adversely affect the visibility through the water. (B.O.G.)

23276

FABRICATING INCONEL PIPING SYSTEMS FOR TF-65 LOOP AND D1G PROTOTYPE. Eugene H. Irwin (Midwest Piping Co., Inc., St. Louis). Nucleonics 18, No. 9, 118; 120; 122; 125(1960) Sept.

An all- Inconel-alloy high-pressure test loop was fabricated and installed. The pipe and fittings for the primary cooling system of the D1G prototype reactor were manufactured by hot-forming from Inconel plate. The specifications required that the 14-in. OD $1\frac{1}{8}$ to $2\frac{3}{4}$ in. wall welding fittings and pipe have a yield point of 30,000 psi. The welding was done by consumable-metallic-electrode inert gas or tungsten-electrode inert gas methods. Inconel "62" filler wires were used and they produced welds of proper quality. To meet the ID tolerances of +0 in. to $\frac{1}{16}$ in. on the elbows and +0 in. to $\frac{1}{32}$ in. on the pipe, they were internally bored on special machines. The outside of the pipe was also machined to tolerance. Destructive tests, radiography, and other tests were made on test rings taken from the finished product. (M.C.G.)

23277

PREPARATION OF TARGETS FROM ISOTOPIC Cr_2O_3. A. D. Bondar, A. P. Klyucharev, L. G. Lishenko, and A. D. Nikolaichuk (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Pribory i Tekh. Ekspt. No. 3, 137-8(1960) May-June. (In Russian)

The design is given for a device for preparing CrI_2 from Cr_2O_3 at 300°C. Depending on the quantity of CrI_2 and the time of dissociation (10 to 45 min), thicknesses of isotopic chromium foil from 1 to 15 μ may then be deposited. The molybdenum base used was disolved in a nitric acid solution. The foils retained their ductility for a long time and were usable for many hours with a 5.5 to 6.8 Mev proton beam current of 10^{-8} amp. (R.V.J.)

23278

PREPARATION OF Zr-D TARGETS WITH COPPER BASE. A. G. Zimelev and R. N. Kuz'min. Pribory i Tekh. Ekspt. No. 3, 139-41(1960) May-June. (In Russian)

The technology of thin (8 to 100 μ) zirconium film deposition on copper is developed, and certain regularities in deuterium absorption by this film are described. (tr-auth)

23279

FUEL ELEMENTS OF HETEROGENEOUS REACTORS. J.-A. Stohr (Commissariat à l'Énergie Atomique, Paris). Tech. moderne 51, 9p. (1959) Mar. (In French)

Nuclear fuels and techniques for the manufacture of fuel elements making up the core of heterogeneous reactors are described. (auth)

23280

IMPROVEMENTS IN METHODS OF MANUFACTURING POROUS MEMBRANES. (to Commissariat à l'Énergie Atomique). British Patent 843,737. Aug. 10, 1960.

A method for the manufacture of porous membranes by evaporating Zn from brass or German silver plates under vacuum is given whereby zinc diffusion and evaporation are increased and alloy grains are made finer. The method involves incorporating Ni and one of the group P, As, and Sb into the alloy and consists of the following steps: (1) The alloy is introduced into molds at 1000 to 1050°C. (2) The ingots are cold-rolled and heated at 600°C alternately. (3) The bands are annealed in N_2 first at 250°C and then at 400°C. (4) After degreasing and scouring, the bands are heated in a vacuum furnace at 10^{-4} mm Hg for 15 min at 650°C. For optimum results, the alloys should contain 35% Zn, and the resulting porous membranes (with 85% of their Zn contents evaporated off) have a pore size of 100 to 500 A. Procedures are given for porous plate preparation from three specific alloys. (D.L.C.)

23281

IMPROVEMENTS IN OR RELATING TO FINNED TUBING HAVING RESISTANCE-WELDED FINS. (to Ferdinand Busse). British Patent 843,967. Aug. 10, 1960.

A method is proposed for the manufacture of finned tubing by attaching fins to tubing; such tubing is suitable for use in heat exchangers for gas-cooled reactor power plants. The method consists of winding U or channel-sectioned metal strip helically around a tube and securing the strip base to the tube surface by electric resistance seam welding. The welding is done with roller electrode devices, and various arrangements for welding are shown, including one in which protuberances are spaced helically on the tube and the strips wound in register with these protuberances. (D.L.C.)

23282

IMPROVEMENTS IN OR RELATING TO ELECTRIC WELDING. Lloyd Blair Kramer, Alvin Harry Kashberg, and John George Landkrohn (to Westinghouse Electric Corp.). British Patent 844,201. Aug. 10, 1960.

A welding chamber-unit is described for making sound welds between alloys of Hf or Zr and common metals such as Cu, Sn, or Zn, and between Hf and Zr. This unit meets the requirements of atmospheric content of $<1 \times 10^{-7}$ part of N_2 and O_2 and comprises a vacuum chamber with an arc welding unit. The chamber includes facilities for mounting and moving the work and welding electrodes by outside motors with shafts entering the chamber by way of rotary vacuum seals. Before use, the chamber is evacuated to $\sim10^{-6}$ mm Hg and filled with a 99.999% pure inert gas, usually He, at 1 atm. Since welding times may take >5 hours, a plurality of tungsten electrodes is provided so that electrode failure will not necessitate opening the chamber; the electrode tip-body diameter ratio is designed for long life. With this chamber-unit, welds were obtained which were corrosion-resistant to water at 600 to 700°F at 2,000 psi. (D.L.C.)

23283

IMPROVEMENTS IN OR RELATING TO METHODS OF MANUFACTURING POROUS BODIES FOR THE SEPARATION OF ISOTOPES. (to Philips Electrical Industries, Ltd.). British Patent 844,719. Aug. 17, 1960.

A method is given for manufacturing porous bodies from CaF_2 for the diffusive separation of the hexafluorides of U^{238} and U^{235}; such bodies have the advantages of chemical resistance to fluorides and the required pore size for isotope separation (~0.01μ). The CaF_2 bodies are prepared by blending granular CaF_2 with an aqueous solution of CaF_2 gel, molding to the desired shape, and heating at 100 to 1200°C as in baking ceramics. The jellifying agent dissociates into volatile and/or involatile products, the latter being chemically inert toward fluorides, leaving a porous body of porous size 0.02 to 0.03 μ. The pore size may be varied in the following ways: (1) Finer CaF_2 means smaller pores. (2) Pore size increases with temperature and heating duration. (3) Reduction of gel-fluorspar ratio results in larger pores. Four procedures are given for the manufacture of porous CaF_2 bodies; the jellifying agents are $Ca(MnO_4)_2$, $Cu(NO_3)_2$, $UO_2(NO_3)_2$, and NH_4NO_3, and the temperatures of heating are 170 and 200°C. (D.L.C.)

23284

METHOD OF PRODUCING DENSE URANIUM OXIDE BODIES. (to United States Atomic Energy Commission). British Patent 844,980. Aug. 17, 1960.

An economical method is proposed for sintering UO_2 bodies to a high density, whereby the use of expensive H_2 is reduced and the furnace can be of the conventional type, e.g., muffle with SiC heating elements. The method comprises three steps: (1) After being ball milled to a grain diameter <1μ, the UO_2 is fired in a H_2 atmosphere for 2 hr at 1200°C. (2) The H_2 is then replaced by steam and the temperature is raised to 1300 to 1400°C and maintained for ~4 hr. (3) Cooling is carried out in a H_2 atmosphere, yielding the final product with 95 to 97 % of theoretical density. Steps 1 and 3 are necessary to keep the O/U atomic ratio below 2.03, whereas step 2 is the actual sintering procedure. It is necessary to keep the temperature in step 2 at 1300 to 1400°C because at 1200°C sintering is too slow and above 1400°C the furnace heating elements are sensitive to oxidation. (D.L.C.)

23285

IMPROVEMENTS IN OR RELATING TO SHEATHED ELEMENTS. George William Kinvig Ford, Leslie Mark Wyatt, and Oliver Sidney Plail (to United Kingdom Atomic Energy Authority). British Patent 845,181. Aug. 17, 1960.

A method and apparatus are described for sealing solid nuclear fuel bodies, e.g., a U rod, in a closely-fitting metal sheath with an internal atmosphere such as He. The apparatus comprises a draw-press with a pumping head arranged to be coupled to a sheath during the drawing of the sheath. Before the drawing operation, the Al sheath is evacuated by withdrawing air from a cavity at the inner end of the U rod via clearance spaces and grooves. He is introduced through a needle valve, and then the ram is operated to drive the loaded sheath through the die, trapping the He gas. (D.L.C.)

Properties and Structure

23286 57-RL-1748

General Electric Co. Research Lab., Schenectady, N. Y.

IRON–ALUMINA MATERIALS. A. Gatti. May 1957. 14p.

Alloys of Al_2O_3 in Fe were produced which contained 8 or 16% alumina by weight. Four methods of obtaining dispersions in iron were studied. These methods are: (1) oxidation-reduction of Fe + 8% Al alloy powders, (2) coprecipitation of $Fe(OH)_3$ and $Al(OH)_3$ from aqueous solution, (3) colloidal mixing of $Fe_2O_3 + Al_2O_3$, and (4) colloidal mixing of Fe powder and Al_2O_3. The powders were treated in H_2 to reduce iron oxides, compacted into billets and extruded at 2200°F to 0.25 in.-diam. rod with a 16 to 1 extrusion ratio. Resulting microstructures are presented together with high temperature tensile and creep rupture properties. The yield stresses of the 16% Al_2O_3 materials were at least four times that of pure iron at the same temperature, while the 8% Al_2O_3 materials were at least twice as strong. An exception at 1800°F may be related to the α to γ phase change. The creep resistance of all the iron–alumina alloys was much greater than that of iron alone. The stresses for 100-hour rupture life at 1200°F were determined. (auth)

23287 AD-233214

Carborundum Co. Research and Development Div., Niagara Falls, N. Y.

DEVELOPMENT OF ULTRA REFRACTORY MATERIALS. Progress Report No. 20 [for] November 1, 1959 through January 31, 1960. Peter T. B. Shaffer. Feb. 15, 1960. 24p. Contract NOrd-17175.

The oxidation rates of ZrB_2, ZrB_2 + 10% $MoSi_2$, ZrB_2–$MoSi_2$–BN, and compounds of ZrB_2 containing Al, Si, and SiC at 3540°F were measured. (For preceding period see AD-228359.) (C.J.G.)

23288 AFOSR-TN-60-83

Illinois. Univ., Urbana.

AN INVESTIGATION OF THE USE OF INTERNAL FRICTION TECHNIQUES IN THE STUDY OF DIFFUSION AND PHASE CHANGES IN METALS. Final Report. James Cost and Charles Wert. May 15, 1960. 33p. Contract AF(603)-22.

Studies were made on the precipitation which precedes the massive heterogeneous precipitation during phase separation in a 70-30 Au–Ni alloy. As possible explanations of the precipitation phenomenon, clustering and ordering phenomena are discussed. Cadmium–magnesium alloy crystals, having a damping effect of the Zener-relaxation type, were studied for anelasticity. Internal friction and diffusion of Fe^{55} and V^{49} were measured in a Fe–18% V alloy. At 840°C the motion of the atoms began to be hindered by magnetic ordering which continued to 500°C. A schematic of the Nb-rich portion of the Nb–O equilibrium diagram is presented. Phase studies were conducted on the N–Nb system. (C.J.G.)

23289 AFOSR-TN-60-694

Franklin Inst. Labs. for Research and Development, Philadelphia.

PROPERTIES OF ZONE REFINED TITANIUM AND ZIRCONIUM. PART I. J. L. Rutherford, R. L. Smith, and M. Herman. July 1960. 32p. Contract AF18(600)-1581. (I-A1878-6).

The properties of zone-refined titanium and zirconium are presented and evaluated. Surveys of the properties along the length of the zone-refined bars are shown which indicate a definite redistribution of impurities as well as some actual purification. The results of tensile tests at 4.2°K and the origin of the serrations appearing in these tensile curves are discussed. (auth)

23290 ANL-6126

Argonne National Lab., Ill.

SELF-DIFFUSION IN BETA URANIUM. Partial Report—Metallurgy Division Program 4.1.2. S. J. Rothman, J. Gray, Jr., J. P. Hughes, and A. L. Harkness. July 1960. 20p. Contract W-31-109-eng-38. OTS.

The self-diffusion coefficient of U decreased from 3×10^{-9} cm^2/sec at 785°C to 2.1×10^{-11} cm^2/sec at 760°C. At temperatures high in the beta phase, the plots of log C vs.

X^2 are curved, indicating that self-diffusion in beta U does not take place by isotropic volume diffusion alone. (auth)

23291 BMI-1454
Battelle Memorial Inst., Columbus, Ohio.
PREPARATION AND EVALUATION OF ALUMINUM-35 w/o URANIUM ALLOYS CONTAINING UP TO 3 w/o TIN OR ZIRCONIUM. Norman E. Daniel, Ellis L. Foster, Jr., and Ronald F. Dickerson. July 29, 1960. 30p. Contract W-7405-eng-92. OTS.

The effects of ternary additions of up to 3 wt.% Sn or Zr to an Al-35 wt.% U extrusion alloy were evaluated on the basis of casting characteristics, UAl_3 retention, extrusion behavior, mechanical properties, and corrosion resistance. Both additions increased the fluidity of the alloy, and both promoted retention of UAl_3. The best fluidity was obtained by a 2 wt.% Sn addition, while Zr was the more effective stabilizer of UAl_3. The retention of UAl_3 decreased the extrusion pressure needed for fabrication and caused a corresponding decrease in tensile and creep-rupture properties. Reductions in strength were most noticeable at elevated temperatures. The 1000-hr stress-rupture strength of the binary alloy at 200°C (8300 psi) was approximately 25 and 11% higher, respectively, than the alloys containing 3 wt.% tin (6200 psi and 3 wt.% zirconium (7400 psi). The additions either slightly improved or had no effect upon the resistance of the Al-35 wt.% alloy in 150°C demineralized water. (auth)

23292 CRMet-924
Atomic Energy of Canada Ltd., Chalk River, Ont.
HYDRIDING ZIRCALOY-2 BY ELECTROLYSIS. A. Sawatzky. June 1960. 14p. (AECL-1046). AECL.

The feasibility of depositing thin layers of hydride on Zircaloy-2 by electrolysis was investigated at 20 to 80°C. The effects of surface condition, electrolytic current density, and temperature were determined. The rate of hydriding was independent of current density for values greater than 100 ma/cm^2. The growth of the hydride layer is considered to be diffusion controlled, with the diffusion coefficient being given by $D = 3.23 \times 10^{-5} \exp(-9700/RT)$ $cm^2\ sec^{-1}$. (auth)

23293 CRMet-937
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A REVIEW OF ZIRCALOY-2 AND ZIRCALOY-4 PROPERTIES RELATING TO THE DESIGN STRESS OF CANDU PRESSURE TUBES. E. C. W. Perryman. June 1960. 36p. (AECL-1048). AECL.

23294 DEG-Report-90
United Kingdom Atomic Energy Authority. Development and Engineering Group, Culcheth, Lancs, England and United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England.
MAGNESIUM DATA MANUAL. PROPERTIES OF INTEREST IN REACTOR DESIGN. B. J. Seddon and E. L. Francis, comps. Jan. 5, 1960. 48p. BIS.

A data compilation on the physical, mechanical, and chemical properties of Mg and its alloys and the effects of irradiation on the properties is presented. 34 references. (C.J.G.)

23295 DMIC-132
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
DESIGN INFORMATION ON NICKEL-BASE ALLOYS FOR AIRCRAFT AND MISSILES. R. J. Favor, D. A. Roberts, and W. P. Achbach. July 20, 1960. 154p. Contract AF18(600)-1375. (PB-151090). OTS.

Tensile, compressive, shear, and bearing properties of some Ni alloys are reviewed and evaluated relative to aircraft and missile applications. Design curves showing the effect of temperature on these properties are presented. (C.J.G.)

23296 HW-60828
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PHOTOGRAPHIC OBSERVATIONS OF THERMAL EFFECTS IN UNIRRADIATED URANIUM DIOXIDE FUEL CORES. H. W. Newkirk and J. L. Bates. June 22, 1959. 12p. Contract AT(45-1)-1350. OTS.

The effects of high temperatures on unirradiated sintered UO_2 pellets were observed through use of photographic techniques. These photographic techniques are described. (C.J.G.)

23297 IS-158
Ames Lab., Ames, Iowa.
URANIUM GLASSES: II. URANIUM SILICATE GLASSES. C. D. Wirkus and D. R. Wilder. 29p. Contract W-7405-eng-82. OTS.

The maximum concentration of UO_2 (45 wt.%) was determined for silicate glasses. A number of stable glasses was developed. The properties of a typical high-urania-content silicate glass are discussed. (auth)

23298 KAPL-2000-10(p.E.29-E.39)
Knolls Atomic Power Lab., Schenectady, N. Y.
EDDY-CURRENT CRACK DETECTION IN SHORT ZIRCALOY TUBING. R. G. Holt.

The use of short Zircaloy sleeves in fuel elements dictates rigorous inspection of each sleeve. To meet the inspection requirements, the Hectmeter, a very sensitive eddy-current test apparatus, was developed. It consists of standard electronic equipment and a simple parallel resonant circuit. The flexibility of the test allows selection of test frequency and coildesign with a minimum of circuit changes. (W.D.M.)

23299 KAPL-M-JOM-2
Knolls Atomic Power Lab., Schenectady, N. Y.
EFFECTS OF ELECTRICAL DISCHARGE MACHINING (ELOXING) OF ZIRCALOY. J. O. Mirate. July 22, 1960. 13p. Contract W-31-109-Eng-52. OTS.

A mock-up section of the SAR RITA receptable was made by the electrical-discharge machining (eloxing) process to determine if any effects are induced to Zircaloy-2 by use of the process. In comparison to conventional machining methods, the eloxing process produced poorer surfaces but enabled more intricate configurations. Hydrogen, absorbed by Zircaloy-2 during the eloxing process, can be removed by vacuum heat-treating. Good corrosive properties in steam or water were exhibited by eloxed Zircaloy prepared by precorrosion pickling. (C.J.G.)

23300 NP-8720
Westinghouse Electric Corp. Research Labs., Pittsburgh.
TENSILE PROPERTIES OF TYPES 304 AND 347 AUSTENITIC STAINLESS STEEL IN THE TEMPERATURE RANGE FROM 75°F TO 800°F. Research Report No. 100FF1007-R1. W. H. Pryle. Sept. 11, 1956. Appendix I: STATISTICAL ANALYSIS. Research Memo 100FF1007-R1. Robert Hooke. Oct. 8, 1956. 60p.

Tests were conducted to determine the minimum yield strength, 0.2% offset, of annealed 304 and 347 stainless steels as a function of temperature in the range 75 to 800°F. Considerable variations of yield strength were found and such variations appear to be directly related to the as-annealed hardness. Yield strength increases as hardness increases in a linear fashion for the hardness range examined. As-annealed hardness is the predominant yield strength controlling factor while carbon and silicon content are secondary controlling factors. Test data for use as a basis for other investigations and for background information are included. (J.R.D.)

23301 NYO-9316
Yale Univ., New Haven. Hammond Metallurgical Lab.
THE ELECTRICAL RESISTIVITY OF LIQUID SODIUM AND DILUTE SODIUM ALLOYS. Final Report. James F. Freedman and W. D. Robertson. Oct. 1959. 45p. Contract AT(30-1)-1857. OTS.

The factors of atomic size, ion core potential, and charge, which contribute to the increment in electrical resistivity produced by solutes in metallic solutions, were separated and experimentally evaluated in liquid sodium. The results are expressed in a semi-empirical relationship which defines the increment in resistivity of a monovalent solution as the sum of the fractional difference in atomic volume of solute and solvent and the difference in atomic number of Na and the solutes Li, K, Cs, Rb, Ag, and Au. (auth)

23302 ORNL-2946
Oak Ridge National Lab., Tenn.
THE STABILITY OF EUROPIUM OXIDE IN SILICON-BEARING STAINLESS STEEL (thesis). C. F. Leitten, Jr. Sept. 12, 1960. 94p. Contract W-7405-eng-26. OTS.

Submitted to the Univ. of Tenn.

The stability of Eu_2O_3 dispersed in silicon-bearing stainless steel powder compacts was studied in the temperature range 900 to 1250°C. The effects of silicon content of the stainless steel powder, oxide conditioning treatment, and heat-treating time and atmosphere were also investigated. (auth)

23303 TID-6345
University of Notre Dame, Notre Dame, Ind.
STUDIES IN NUCLEAR SPECTROSCOPY. Technical Progress Report [for] October 15, 1959 through June 30, 1960. Richard C. Pilger, Jr. 7p. Contract AT(11-1)-834. OTS.

Equipment is being constructed and ordered for decay studies of Ra^{223}, Rn^{219}, and Fr^{223}. The electron capture decay of Lu^{173}, populating levels and giving rise to internal transitions in Yb^{173}, was studied experimentally. (W.L.H.)

23304 TID-6382
Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. Annual Report. G. Derge. July 1960. 18p. Contract AT(30-1)-1024. OTS.

In electrochemical studies of Ni–S melts it was found that these compounds have the characteristics of metal alloys rather than semiconductors. Structural models of $CaO-Al_2O_3-SiO_2$ based on self diffusion observation are presented. A study of the density of $FeO-SiO_2$ melts is being conducted by the maximum bubble pressure method. A study of electric conductivity and thermoelectric properties of a thallium alloy system is also in progress. Data accumulated to date are summarized along with relevant data on other newly investigated systems. Hall-effect measurements in melts of interest are also reported. A proposal for further research and a contract administrative summary are included. (J.R.D.)

23305 WADC-TR-58-478(Pt.II)
Brush Beryllium Co., Cleveland.
DEVELOPMENT OF WROUGHT BERYLLIUM ALLOYS OF IMPROVED PROPERTIES. Period covered: July 1, 1958 to June 30, 1959. John G. Klein, Leslie M. Perelman, and Wallace W. Beaver. Sept. 1, 1959. 128p. Project 7351. USAF Delivery Order 33(616)-57-19. OTS.

Mechanical and physical properties are reported for extruded and/or rolled products fabricated from beryllium-rich alloys of silver, tin, cadmium, zinc, nickel, and copper, as well as beryllium fabricated from subsieve-size powder and powder of higher than normal beryllium oxide content. (auth)

23306 WADD-TR-60-37
Westinghouse Electric Corp. Lamp Div., Bloomfield, N. J.
PHYSICAL METALLURGY OF TUNGSTEN AND TUNGSTEN BASE ALLOYS. Period covered: April 1, 1958 to November 30, 1959. Russell H. Atkinson, et al. Dec. 1959. 250p. Project No. 7351. Contract AF33(616)-5632.

Base line data revealed that the tensile transition temperature of W is not strongly influenced by gaseous impurities of 10 to 50 ppm but may be affected by metallic impurities of 10 to 30 ppm. The recrystallization temperature of W (1300 to 1400°C for 30 anneals) was increased to ~1800°C by the presence of 50 ppm of Al. Trace impurity levels exhibited only slight influence on tensile behavior of W up to 2700°C, but at 2250 to 2700°C ductility decreased sharply with increasing temperature and was accompanied by an anomalous and poorly reproducible creep-rupture behavior. Deformation of single crystals is accompanied by twinning. Low-temperature yield point phenomena were observed and are tentatively attributed to H. Polycrystalline W exhibited several low magnitude internal friction peaks of undetermined origin at 65, 150, 550, and 700°C. Single crystals after a 400°C anneal showed no peaks. Purposeful introduction of C and O into W at elevated temperatures did not produce homogeneous distributions of these elements in concentrations above 20 to 40 ppm. The addition of ThO_2 in concentrations of 2 to 4 wt.% increased the recrystallization temperature of W by 400 to 600°C and thereby increased the yield strength at 2700°F by a factor of 2 to 3.5 (to 33,000 psi) and the 100-hr creep rupture strength by a factor of 2. The addition of 0.38 wt.% TaC as a dispersed second phase in W increased the yield stress at 2500°F to 56,000 psi. (C.J.G.)

23307 AEC-tr-4209
PRECIPITATION PROCESSES IN TITANIUM-STABILIZED AUSTENITIC NICKEL–CHROMIUM STEEL AND THEIR RELATION TO INTERCRYSTALLINE CORROSION PHENOMENA. K. Bungardt and G. Lennartz. Translated from Arch. Eisenhüttenw. 27, 127-3(1956). 19p. JCL.

Analytical and x-ray photographical examinations of steel with 0.07% C, 17.5% Cr, 0.4% Mo, 0.013% N, 10.4% Ni, and 0.47% Ti were made concerning the influence of the quenching temperature and the time at the quenching temperature on the progress of precipitation with subsequent annealing between 500 and 800°. A correlation of the tendency of the grain structure to disintegrate was found in tests with boiling copper sulfate–sulfuric acid solutions. (auth)

23308 IG-Inf. Ser. 14
DAMPING IN METALS. R. Fichter. Translated by S. Muir (U.K.A.E.A., Risley) from Schweiz. Arch. angew. Wiss. u. tech. 24, 65-78(1958). 27p.

A report based on previously published articles is presented in which damping is treated as an aid in research on metallic structures. Fundamentals are discussed and the methods and apparatus of measurement are examined. The causes of damping are described, and results of measurements in structural research are set forth. Nondestructive testing of materials with the aid of damping measurements is briefly reviewed. (auth)

23309 IGRL-T/C-95
THE INFLUENCE OF CHEMICAL COMPOSITION AND STRUCTURE ON THE HYDROGEN CONTENT OF IRON

AND STEEL. PART I. THE INFLUENCE OF SILICON, CARBON AND STRUCTURE ON THE BEHAVIOUR OF HYDROGEN IN UNALLOYED STEELS. F. Erdmann-Jesnitzer and H. Sabath. Translated by R. French (U.K.A.E.A. Risley) from Arch. Eisenhüttenw. 28, 345-53(1957). 24p.

The laws governing the loss and uptake of H in a weld metal are discussed. Methods for the measurement of diffusible H in materials are reviewed. Hydrogen losses as a function of degassing time are discussed. The effect of Si on H loss in metals was studied. The influence of C and the metallurgical structure on the permeability of steels by H was studied. 56 references. (C.J.G.)

23310 NP-tr-471

MAGNETIC INVESTIGATIONS OF GOLD-BASED SOLID SOLUTIONS WITH TITANIUM AND VANADIUM. E. Vogt and D. Gerstenberg. Translated by R. Hardbottle (U.K.A.E.A. Atomic Energy Research Establishment) from Ann. Physik (7), 4, 145-53(1959). 21p. (Includes original, 4p.). JCL.

Susceptibility measurements were made between 90 and 900°K in the range of α solid solutions of gold with titanium and vanadium. Titanium enters the lattice of gold with a paramagnetism that is independent of the temperature but is directly proportional to the concentration. Vanadium dissolved in gold exhibits a behavior intermediate between that of titanium and that of chromium which, like the following transition elements, dissolves in gold with a magnetic ionic moment. The susceptibility of dissolved vanadium comprises a temperature-independent susceptibility and a Curie-Weiss susceptibility, which are additive but neither of which is directly proportional to the concentration. Relative to 1 g-atom of addition the Curie-Weiss susceptibility rapidly decreases, so that the number of moments per g-atom of alloy varies only slightly between 1 and 15 at.%. Possible ways of interpreting this behavior are discussed, based on the one hand on band theory, and on the other on Friedel's theory of localized d-states with resonance broadening and exchange splitting. (auth)

23311

YIELD AND FRACTURE IN POLYCRYSTALLINE NIOBIUM. M. A. Adams (Materials Research Corp., Yonkers, N. Y.), A. C. Roberts, and R. E. Smallman. Acta Met. 8, 328-37 (1960) May.

Tensile tests on specimens prepared from an ingot of electron-bombardment melted niobium showed that the material undergoes a ductile–brittle transition and can be made to twin. The variation of yield stress σ_y with grain-size 2d was used to determine the effect of temperature (293 to 20°K at a strain-rate of 2.02×10^{-4} sec^{-1}) and strain-rate (2.02×10^{-4} sec^{-1} -6.18×10^{-2} sec^{-1} at 77°K) on the values of σ_i and k_y in a Petch type equation $\sigma_y = \sigma_i + k_y d^{-1/2}$. Results indicated that the ductile-brittle transition characteristics are in accordance with Cottrell's transition equation $(\sigma_i d^{1/2} + k_y)k_y = \beta\mu\gamma$. Niobium shows a greater resistance to brittleness than carburized α-iron because it has a smaller k_y value, and the reluctance of the material to twin except under extreme conditions of low temperature or high strain-rate is also attributed to a low value of k_y. The mechanical behavior of niobium relative to that of other body-centered cubic transition metals was discussed. (auth)

23312

CONTRIBUTION TO THE STUDY OF IRON–ALUMINUM ALLOYS. E. Hugony and C. Garino (Istituto Sperimentale dei Metalli Leggeri, Milan). Alluminio 29, 339-50(1960) July-Aug. (In Italian)

After a discussion of recent studies on Fe–Al alloys, the results of tests made during use under heat and in sulfurizing atmospheres were described. Tests were made with cast iron containing high and low concentrations of Al and with steels with a medium Al concentration. The samples were prepared both in the laboratory and in the foundry. Satisfactory results and practical applications were obtained. (tr-auth)

23313

EFFECT OF LONG AGING AT ROOM TEMPERATURE ON THE MECHANICAL PROPERTIES OF SOME LIGHT ALLOYS. L. Mori (Istituto Sperimentale dei Metalli Leggeri, Novara, Italy). Alluminio 29, 351-7(1960) July-Aug. (In Italian)

After 40,000 hr of aging at room temperature, Al–Mg alloys undergo a decrease in R and $s_{0.2}$ and an increase in A comparable with that produced by annealing for 5 hr at 90 to 100°C and proportional to the Mg concentration and the degree of cold working. Smaller variations were noticed in Al 99, 99.5, 99.8, and 99.99. In the alloy Am 30 an increase of R and $s_{0.2}$ and a decrease of A were detected. (tr-auth)

23314

SILICON CARBIDE FOR NUCLEAR REACTORS. G. M. Butler, Jr. (Carborundum Co., Niagara Falls, N. Y.). Am. Ceram. Soc. Bull. 39, 402-7(1960) Aug.

It was shown that silicon carbide has many properties which compare favorably with other non-metallic reactor core materials but that its lack of moderating ability has hindered its study for air-breathing reactors. Its use as a protective coating for graphite is being actively investigated. Structural parts in gas-cooled reactors will probably be made from silicon carbide materials, and temperature-sensing elements based on its uniquely high voltage generating ability may be employed. (auth)

23315

USE OF NEUTRON ACTIVATION ANALYSIS FOR DETERMINING EFFECTIVENESS OF ZONE-REFINING TECHNIQUES IN THE PURIFICATION OF ALUMINUM. W. D. Mackintosh (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Anal. Chem. 32, 1272-5(1960) Sept.

When Al is zone-refined, each impurity behaves differently. It is therefore desirable, when assessing the effectiveness of a particular zone-refining process, to determine the changes in concentration of as many impurities as possible. Neutron activation analysis can be advantageously employed to determine a considerable number of the impurities. In the study of a bar of zone-refined Al, 13 impurity elements were determined. The results indicate the degree to which the zone-refining process has reduced the concentrations of these impurities in the central region of the bar. (auth)

23316

ANALYSIS OF THE PHENOMENON OF CREEP ON THE BASIS OF STATIC TESTS FOR TENSION. Jerzy Wantuchowski. Arch. Hutnictwa 3, 201-26(1958). (Translated from Referat. Zhur. Fiz. No. 6, 1959, abstract No. 13118).

Using a machine for static testing, a study was made of the influence of the method and rate of loading on the course of the creep curve. A metallic specimen was subjected first to static tests for tension up to a certain value of the load, and then to a test for creep at a constant load. The speed of tension of the specimen in the initial phase preceding the creep of the metal, as well as the value of the constant load which determines the start of the creep phenomenon, were varied. The duration of the initial phase fluctuates from 16 minutes to nine days, and the tests for creep proper averaged two days each. The values of the elongations and loads obtained in this manner and recorded as functions of the time were used to calculate the stress, the hardening, and the speed of deformation for all creep tests.

23317

PROCESSES IN MELTING FOR CARBURIZATION OF STEEL EXPERIMENTS WITH C^{14}. H. Ornig (Technische Hochschule, Graz). Atompraxis 6, 129-32(1960) Apr.-May. (In German)

The cyanides, cyanates, and carbonates present in carburizing salt bath exchange their carbon atoms between 450 and 650°C at a measurable speed. With the aid of this exchange, cyanides and cyanates can be labelled with C^{14} from $BaC^{14}O_3$. The carbon taken up by iron between 510 and 560°C comes mainly from the cyanides. (auth)

23318

LUBRICANTS IN NUCLEAR POWER PLANTS. W. Gross. Atompraxis 6, 260-5(1960). (In German)

Examples of suitable lubrication for conventional machines are given, and the development of special radiation-resistant lubricants is discussed, together with their range of application. Corrosion during construction and mounting, as well as during occasional plant shutdowns, can be lessened by using anti corrosion materials. Such materials, their application, and their effect are described. Lubricants change during use, even in conventional machines. General rules are set up for the application range of lubricants and for the necessary testing procedures in monitoring. (auth)

23319

MAGNETIC STRUCTURE OF NICKEL MANGANITE. Bernard Boucher (Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 248, 514-16(1959) July 27. (In French)

The manganite $NiMn_2O_4$ has a face-centered cubic lattice and presents the inverse spinel structure. At 4.2°K the neutron diffraction spectrum shows magnetic bands superimposed on the nuclear bands. These bands are explained by a pyramidal spin coupling. The pyramid can degenerate and give a triangular coupling. (auth)

23320

HYDROGEN PERMEATION THROUGH METALS, ALLOYS AND OXIDES AT ELEVATED TEMPERATURES. C. L. Huffine and J. M. Williams (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Corrosion 16, 430t-2t(1960) Sept.

Permeation rates of hydrogen through AISI Type 446 stainless steel and an iron-chromium-aluminum alloy (20 % Cr, 5 % Al, balance Fe) were determined to 2150°F under various conditions of surface oxidation. The presence of a continuous oxide film resulted in a thousand fold reduction in permeation rate over that through the unoxidized metal at elevated temperatures. Under conditions in which the oxide could not be replenished, its barrier effect was largely destroyed through reduction of the oxide by the emerging hydrogen. (auth)

23321

THE SYSTEM UO_2-ZrO_2. P. E. Evans (Univ. of Manchester, Eng.). J. Am. Ceram. Soc. 43, 443-7(1960) Sept.

A phase diagram was proposed for the system UO_2-ZrO_2 on the basis of earlier work and the results of new studies in which the mixed oxides were melted in a solar furnace to avoid contamination. X-ray diffraction measurements were made on specimens melted in helium and on the same specimens after heating to 1350°C in helium. The system shows a narrow two-phase region about the eutectic at high temperatures which increases in extent at lower temperatures. The high-temperature form of zirconia cannot be stabilized by the addition of UO_2. (auth)

23322

OXYGEN MOBILITY IN POLYCRYSTALLINE $NiCr_2O_4$ AND α-Fe_2O_3. W. D. Kingery, D. C. Hill, and R. P. Nelson (Massachusetts Inst. of Tech., Cambridge). J. Am. Ceram. Soc. 43, 473-6(1960) Sept.

Oxygen diffusion coefficients were determined for polycrystalline samples of $NiCr_2O_4$ and α-Fe_2O_3 by exchange measurements with oxygen gas containing the stable isotope O^{18}, using mass spectrometer analysis. Oxygen diffusion in $NiCr_2O_4$ can be represented by the equation $D = 0.017 \exp(-65,400/RT)$. Oxygen diffusion in α-Fe_2O_3 can be represented by the equation $D = 1 \times 10^{11} \exp (146,000/RT)$. The large difference between D_0 and activation energy for these materials suggests that different diffusion mechanisms are involved. (auth)

23323

SOME PHYSICAL PROPERTIES OF THORIA REINFORCED BY METAL FIBERS. Y. Baskin, Y. Harada, and J. H. Handwerk (Illinois Inst. of Tech., Chicago and Argonne National Lab., Ill.). J. Am. Ceram. Soc. 43, 489-92(1960) Sept.

Values were presented for several physical properties of thoria reinforced by metal fibers. Properties determined at room temperature include compressive strength, modulus of rupture, and Young's modulus (dynamic method). Those properties determined at elevated temperatures include modulus of rupture, Young's modulus, thermal conductivity, thermal expansion, and oxidation resistance. The widespread presence of fine cracks in reinforced thoria results in significantly lower strengths compared with thoria alone. The thermal conductivity of reinforced thoria is slightly greater than that of thoria at room temperature, and the difference becomes more pronounced at elevated temperatures. (auth)

23324

THE HIGH-TEMPERATURE CUBIC PHASES OF URANIUM AND LANTHANUM DICARBIDES. M. A. Bredig (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc. 43, 493 (1960) Sept.

A high-temperature x-ray diffractometer was used to search for cubic high-temperature structure in UC_2 and LaC_2. An x-ray pattern of UC_2 taken at 1850°C showed a face-centered cubic structure that changed into the tetragonal phase on cooling. Lanthanum dicarbide was found to form a cubic phase at 1750°C which also reverted to the common tetragonal form during cooling. A pyrite-type structure was suggested for these compounds. (M.C.G.)

23325

THERMAL EXPANSION OF HAFNIUM CARBIDE. Salvatore J. Grisaffe (National Aeronautics and Space Administration, Cleveland). J. Am. Ceram. Soc. 43, 494(1960) Sept.

The thermal expansion of HfC was measured with a Gaertner dilatation interferometer calibrated to an accuracy of ±1°F. Each run involved heating the test cones at about the rate of 8°F per minute to the desired test temperature and then cooling at the same rate. Density variation in the high-density range appeared to have no effect on the thermal expansion. The coefficient of thermal expansion was calculated to be $3.66 \pm 0.02 \times 10^{-6}$ per °F from 77 to 1133°F or $6.59 \pm 0.04 \times 10^{-6}$ per °C from 25 to 612°C. (M.C.G.)

23326

THE HEAT CAPACITY OF LITHIUM CHLORIDE FROM 15 TO 325 DEGREES KELVIN. D. A. Shirley (Univ. of California, Berkeley). J. Am. Chem. Soc. 82, 3841-3 (1960) Aug. 5.

The heat capacity of LiC was measured in the temperature range 15 to 325°K. The data are analyzed in terms of an optical branch model and found to agree qualitatively but not quantitatively with this model. A relationship derived from this model between heat capacity and elastic constants is found to be obeyed roughly by several alkali halides. For LiCl, $S_{298.15}$ is -14.17 ± 0.02 gibbs/mole. (auth)

23327

STUDY ON THE THERMAL CYCLING EFFECT OF URANIUM BY X-RAY INVERSE POLE FIGURE METHOD. I. STUDY ON URANIUM FUEL ELEMENT. Michio Ichikawa and Kiyoaki Taketani (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 406-11(1960) July. (In Japanese)

For the purpose of developing the fuel elements used in JRR-3, the properties of uranium rods fabricated to 10 mm in diameter are studied. The effects of β-treatment on uranium fuel rods were studied from the point of inverse pole figures method. The effect of thermal cycling on the 300°C rolled uranium rods textures is compared with the effects of recrystallization. Specimens were thermally cycled up to 1,000 times and the changes of the inverse pole figures were carefully examined. Remarkable changes occurred in the inverse pole figures of 300°C rolled uranium specimens completely before 300 cycles, and little change was observed from 300 to 1,000 cycles. It becomes clear from these data that the pole figures of the specimens which were thermally cycled are very similar to that of the partially recrystallized ones. (auth)

23328

A STUDY OF THE THORIUM-TUNGSTEN-BORON SYSTEM. Douglas T. Pitman and Dilip K. Das (Raytheon Co., Burlington, Mass.). J. Electrochem. Soc. 107, 763-72 (1960) Sept.

A phase diagram for the Th-W-B system was determined by x-ray diffraction of samples fired to a brightness temperature of 1800°C and furnace cooled. A ternary compound was found with a probable composition of $ThWB_4$. This compound was monoclinic with lattice parameters ($a = 12.25$, $b = 3.75$, $c = 6.14\text{Å}$, and $\beta = 104.1°$). The stability of the thorium and tungsten borides and their reaction with ThO_2 were also investigated. (auth)

23329

A STUDY OF THE THERMAL-FATIGUE BEHAVIOR OF METALS. THE EFFECT OF TEST CONDITIONS ON NICKEL-BASE HIGH-TEMPERATURE ALLOYS. E. Glenny and T. A. Taylor (National Gas Turbine Establishment, Farnborough, Hants, Eng.). J. Inst. Metals 88, 449-61 (1960) July.

An attempt was made to identify the significant factors governing the thermal-fatigue behavior of nickel-base high-temperature alloys, by using a laboratory technique with hot and cold fluidized beds as the heating and cooling media. A succession of heating shocks was generally more damaging than a succession of cooling shocks between the same temperature limits. The duration of the heating shock and the upper temperature of the cycle were dominant factors. The thermal fatigue cracks were initiated at the surface and were intercrystalline in origin and propagation. Surface oxidation, which was intergranular in nature for nickel-base alloys, had a significant effect on thermal-fatigue life. (auth)

23330

INFLUENCE OF HEAT-TREATMENT AND COMPOSITION ON THE MICROSTRUCTURE AND CREEP BEHAVIOUR OF A NIMONIC 80A-TYPE ALLOY. C. W. Weaver (Defence Standards Labs., Maribyrnong, Australia). J. Inst. Metals 88, 462-7(1960) July.

The microstructure and creep behavior of laboratory-produced Nimonic 80A-type alloys were found to be strongly affected by heat-treatment, which controlled the distribution of carbide phases. Consistently improved creep properties were obtained by direct transfer after solution-treatment at 1200°C to temperatures in the range 950 to 980°C. This procedure led to coarse grain-boundary segregation of a duplex precipitate consisting of chromium carbide particles mixed with some γ' phase, $Ni_3(Ti, Al)$. This structure gave long life and good ductility in creep. Heat-treatments that produced finely dispersed carbide in the matrix resulted in short times to rupture, with low elongations. In alloys of very low carbon content there was insufficient carbide precipitation to cause any appreciable response to these heat-treatments. The beneficial effects of coarse segregation of complex mixed carbide/γ' precipitates at grain boundaries are attributed to modifications in the formation and rate of growth of intergranular microcracks. (auth)

23331

A NOTE ON THE URANIUM-BORON ALLOY SYSTEM. CORRECTION. J. Inst. Metals 88, 467(1960) July.

A correction was made in the equilibrium diagram of the uranium-boron system that appeared in "A Note on the Uranium-Boron Alloy System" by B. W. Howlett. Three further melting points were determined and included (See NSA 14: 6701 for original abstract). (M.C.G.)

23332

GRAPHITIZATION STRESS IN POLYCRYSTALLINE CARBON AS AN ORIGIN OF DISLOCATIONS. Takuro Tsuzuku (Nihon Univ., Tokyo). J. Phys. Soc. Japan 15, 1373-9(1960) Aug. (In English)

When a polycrystalline carbon is heat-treated for graphitization, large thermal stress is produced owing to the interference of the extremely anisotropic expansion of each crystallite. The stress of this kind is expected to promote the rearrangement of the crystallites, directly or indirectly, from the so-called turbostratic structure to the tri-dimensional graphite lattice. The stress analysis was made on each of the spherical and the cylindrical (filamentarily textured) polycrystals in which the carbon crystallites are aligned with the basal planes parallel to the external surface. These two models accommodate to the structure of pyrolytic carbon particle and to that of fibrous soft coke, respectively. It is shown that in either of these two cases about 3×10^{10} dynes/cm^2 tension in α-direction and about 0.9×10^{10} dynes/cm^2 compression in c-direction can be produced by heat treatment at 2500°C, which are enough to buckle the crystal lattice at the stress concentrations of 5 to 20 times and may lead to the generation of dislocations. From the corresponding strain distribution curves, the criterion on the stress relaxation by these dislocations was determined in connection with the crystallite size, which may give a measure of distinction between the so-called soft and hard carbons. (auth)

23333

X-RAY MEASUREMENT OF THE SCATTERING FACTOR OF IRON IN ORDERED Fe_3Al. Yukitomo Komura (Osaka City Univ.), Yujiro Tomiie, and Robert Nathans. J. Phys. Soc. Japan 15, 1434-9(1960) Aug. (In English)

X-ray measurements on the absolute integrated intensities of several superlattice reflections on an ordered Fe_3Al single crystal were made to obtain an estimate of the number of localized 3d electrons in iron. The experiments were made with MoK_α radiation with a thin single crystal cut for transmission geometry so as to avoid surface roughness effects. Extinction effects, minimized by restricting the measurements to the comparatively weak superlattice reflections, were estimated from a wavelength analysis of the integrated intensities. Finally, neutron analysis was used for obtaining a knowledge of the state of atomic ordering in the particular sample and for establishing the temperature factors of the iron and aluminum atoms. Calculations of the iron scattering factor from the final results show it to be in substantial agreement with that of the free iron atom (6 3d electrons). This is in agreement with the conclusions of Batterman and contrasts with the low number of 3d electrons given by Weiss and DeMarco. (auth)

23334

A DIFFUSE REFLEXION FROM A SILICON CARBIDE CRYSTAL. Takanori Tomita (Saitama Univ., Urawa, [Japan]). J. Phys. Soc. Japan 15, 1540-1(1960) Aug. (In English)

A small crystallite of polycrystalline SiC was irradiated with a microbeam from a fine x-ray source, and a c-axis oscillation photograph of the diffuse reflection reveals five maxima. In order to explain those maxima, a disordered sequence of many ordered ranges having 6-layer structure is studied with phase relations from a SiC 174-layer analysis introduced between any two ranges. Intensity changes are calculated and tabulated for the 18 phase relations, and the P + 2 + Q(00) phase relation is seen to resemble the oscillation photograph. (D.L.C.)

23335

EMBRITTLEMENT OF METALS BY HYDROGEN. INFLUENCE OF THE CRYSTALLOGRAPHIC AND ELECTRONIC STRUCTURE. P. Blanchard and A. R. Troiano (Case Inst. of Tech., Cleveland). Mém. sci. rev. mét. 57, 409-22(1960) June. (In French)

The embrittlement of several austenitic alloys by hydrogen was studied. The high-nickel austenitic alloys were embrittled by hydrogen. This proves that the structure of an alloy is not an absolute criterion for predicting its susceptibility to hydrogen embrittlement. The theory of fractures developed by Cottrell was applied to the problem of hydrogen embrittlement. A possible explanation of the fact that it is only the transition metals which have so far been embrittled by hydrogen is also presented. The hypotheses formulated seem to be confirmed by results obtained on Ni–Cr, Ni–Fe, Ni–Cr–Fe, and Ni–Cu alloys. (auth)

23336

THE EFFECT OF PRESSURE ON DIFFUSION IN U–Al, U–Cu, AND U–Ni SYSTEMS. Y. Adda, M. Beyeler, A. Kirianenko, and B. Pernot (Centre d'Études Nucléaires, Saclay, France). Mém. sci. rev. mét. 57, 423-34(1960) June. (In French)

Marked variations in composition are shown to occur in the intermetallic compounds, which are theoretically stoichiometrical, owing to diffusion in the U–Cu, U–Ni, and U–Al couples under external pressure. These variations are eliminated by the application of hydrostatic or uniaxial pressure above 500 kg/cm^2 during the diffusion treatment, and thermodynamic equilibrium appeared to have been obtained. (auth)

23337

MECHANISM OF γ-PHASE DECOMPOSITION IN URANIUM–MOLYBDENUM AND URANIUM–MOLYBDENUM–RUTHENIUM ALLOYS. G. Donzé and G. Cabane (Centre d'Études Nucléaires, Saclay, France). Mém. sci. rev. mét. 57, 450-8(1960) June. (In French)

In uranium alloys containing 8 to 20 at.% of molybdenum, the decomposition during anneal of the cubic solid solution bears a perlitic feature. X-ray diffraction analysis shows that lamellae of α uranium are formed, between which the γ-solid solution enriches slowly at first, then abruptly by ordering. After quenching from a high temperature, an addition of ruthenium allows the formation during anneal of a new type of decomposition characterized by platelets oriented with respect to the γ matrix. (auth)

23338

INFLUENCE OF HEAT TREATMENTS ON THE TRANSFORMATION OF CARBIDES IN CHROMIUM–MOLYBDENUM STEELS. L. Bäcker (Aciéries de Pompey, France), R. Bigot, and E. Herzog. Mém. sci. rev. mét. 57, 527-34 (1960) July. (In French)

The technique of electrochemical separation of the carbides was used to study the influence of heat treatment on the transformation of phases in low-carbon Cr–Mo–Al–V steels. It shows the effect of aluminum on the one hand on the appearance of the Cr_7C_3 type of chromium carbide and on the other hand on the existence of a molybdenum carbide γ MoC. (auth)

23339

EMBRITTLEMENT AND FRACTURES OF STEELS SUBJECTED TO STRESS IN SATURATED SOLUTIONS OF H_2S. E. Herzog and E. Malinowski (Aciéries de Pompey, France). Mém. sci. rev. mét. 57, 535-49(1960) July. (In French)

The influence of H_2S content on embrittlement was studied in the absence of stress and on the velocity of rupture under stress in the case of mild steels not stabilized with Ti, a soft Cr–Al–Mo–V steel and medium-strength Mn–Mo and Cr–Mo steels. For the medium-strength steels, the H_2S content affects the speed of fracture under stress, whereas it is practically without effect on the stress-free embrittlement. Tests were also made with a soda solution saturated with H_2S. In the absence of stress, no embrittlement is observed in this. In the presence of stress, this reagent causes fracture. (auth)

23340

STUDY OF THE KIRKENDALL EFFECT AS A FUNCTION OF CONCENTRATION IN URANIUM–ZIRCONIUM DIFFUSION. Y. Adda, C. Mairy, and J. L. Andreu (Centre d'Etudes Nucléaires, Saclay, France). Mém. sci. rev. mét. 57, 550-6(1960) July. (In French)

The Kirkendall effect in uranium–zirconium diffusion was studied in all concentration ranges. The experimental procedure used was to put tungsten markers at the interfaces of a couple constituted by a stack of zirconium and uranium thin foils. Markers move toward uranium for the concentrations between 5 and 100 at.% U, and toward zirconium for the concentrations between 0 and 5 at.% U. An interpretation of this phenomenon, based on the Darken relations, is suggested by the variations of the intrinsic diffusion coefficients D_{U^*} and D_{Zr^*} and verified by the values of the self-diffusion coefficients. (auth)

23341

THE EFFECT OF COBALT ON THE PROPERTIES OF CHROMIUM STEELS. D. Coutsouradis and L. Habraken (C.N.R.M., Liége). Mém. sci. rev. mét. 57, 557-71(1960) July. (In French)

Alloys were prepared with the currently used carbon and chromium contents. The effect of low cobalt additions (up to 10 per cent) was studied. By studying specimens heateated for long periods, using metallographic, x-ray, and ırbide extraction methods, the phases present in equilibum for various temperatures were determined. A number diagrams show sections with two constant variables hromium and carbon, or temperature and cobalt, or caron and cobalt); it is seen that, whereas the influence of the obalt on the solidus and liquidus and the transformation of e carbides is negligible, the gamma radiation effect of e cobalt becomes more marked as the chromium content increased. Also studied was the effect of low cobalt aditions in some currently used chromium steels with 13, 8, and 27% of chromium. In all the steels studied, the tenile strength is increased by solution treatment or in irect proportion to the gamma radiation effect of the coalt. Further, the behavior of these steels is studied as egards temper brittleness at 475°C and the formation of e δ phase. The corrosion resistance of the steels was inestigated by immersion tests with sulfuric acid and boilg nitric acid and by electrochemical tests. The cobalt is ound to have a favorable influence. (auth)

3342

ILATOMETRIC STUDY OF RECOVERY AND RECRYSALLIZATION OF SINGLE CRYSTALS OF α URANIUM OMPRESSIVELY STRESSED. Georges Cizeron, Daniel alais, Bernard Pinteau, and Paul Lacombe (Institut ational des Sciences et Techniques Nucléaires, Saclay, rance). Mém. sci. rev. mét. 57, 589-602(1960) Aug. n French)

The reversibility of the dilatometric curves of the single rystals is first studied. The crystals were obtained by hase changes. The reversibility disappears in the presnce of "insular" grains and also in polycrystals having weak texture. After a compressive stress, according the magnitude of the stress and the axis of deformation, ither recovery or crystallization or both appears. In all ases upon recycling the dilatometric curves remain irly reversible due to the strong recrystallization texures obtained. (tr-auth)

3343

ORON COATING FROM THE VAPOR PHASE IN BORON RICHLORIDE MEDIUM. M. A. Pchelkina and Yu. M. akhtin. Metalloved. i Termichesk. Obrabotka Metal. o. 7, 40-2(1960) July. (In Russian)

Boron coating of steels is much used because it inreases their surface hardness and their resistance to orrosion and abrasion at high temperature. The condions for deposition from the vapor phase were investiated. By the interaction of $BCl_3 + H_2$, active boron is ormed which can easily react with the surface of the etal to be treated; the HCl obtained assists this reacon by removing the oxide film from the surface. Best esults were obtained with a BCl_3/H_2 ratio = 0.05, keepg the BCl_3 at −50°C. Increasing the coating temperature om 750 to 950°C resulted in a strong increase of the difsion layer. Higher carbon content of the steels tended to ecrease this layer, especially in the concentration range to 0.4% carbon. The hardness of the rhombic FeB (η-hase) was found to be 2340 and that of the tetragonal Fe_2B -phase) 1680 to 1290 kg/mm^2. (TTT)

3344

ITRIDING OF TITANIUM UNDER REDUCED NITROGEN ARTIAL PRESSURE. A. V. Smirnov and A. D. Nachinkov. etalloved. i Termichesk. Obrabotka Metal. No. 7, 42-7 960) July. (In Russian)

Nitriding titanium in a mixture of technical grade A + N ases under a reduced partial pressure of the nitrogen ade it possible to form diffusion layers without an external crust. A deeper penetration of the metal is thus achieved than when pure nitrogen gas without a diluent is used because in the latter case the crust formed retards the diffusion. In all cases TiN or another nitride, TiN_x, is formed. In order to avoid the formation of the outside layer, the nitrogen partial pressure must be kept at 0.005 atm, the temperature at 850°C, and the duration of the process must be limited to less than one day. It is, however, possible to achieve the same results even with a nitrogen partial pressure of 0.01 atm if the nitrogen addition is periodically interrupted. The presence of aluminum in the titanium alloy increases the depth of penetration while silicon, tin, and manganese decrease it. In the absence of the external layer, a more uniform hardness distribution is obtained. (TTT)

23345

THE STRUCTURE OF NITRIDED STEEL 15Kh11MF AFTER SOAKING AT ELEVATED TEMPERATURES. A. V. Kostenko, E. V. Lopukhina, T. M. Pogrebetskaya, and A. A. Yurgenson. Metalloved. i Termichesk. Obrabotka Metal. No. 7, 48-52(1960) July. (In Russian)

In view of the previously reported reduction of the surface hardness of nitrided austenitic and stainless steels after exposure to high temperatures, the structural changes occurring in the nitride layer were investigated. It was found that the chief effect of such exposure to 570°C consists in the formation of oxides, primarily in the oxidation of iron nitrides. The nitrides consist of homogeneous solid solutions with considerable lattice vacancies through which hydrogen may diffuse with relative ease. The oxidation rate of iron increases rapidly beyond the eutectic temperature of 570°C, which seems to be the result of the increased diffusion of iron through the porous Fe_3O_4-type lattice. Continued oxidation results in the formation of a spinel phase of $FeO \cdot Cr_2O_3$ which hinders the diffusion process. (TTT)

23346

EMBRITTLEMENT OF STEEL BY ANTICORROSIVE NITRIDING. I. E. Soloveichik and M. L. Finkel'shtein ("Dinamo" Plant, Moscow). Metalloved. i Termichesk. Obrabotka Metal. No. 7, 52-4(1960) July. (In Russian)

In view of the embrittlement of nitrided steel goods, a new treatment was worked out. Low carbon steels must be quenched with water or oil from 800 to 840°C; special steels must be quenched from 840°C, followed by annealing at 650°C for 1 hr. The heat-treatment results in a considerable increase in the resilience of the steels. (TTT)

23347

STUDY OF URANIUM–MOLYBDENUM ALLOYS. Jean Bellot, Pierre Dosière, and Jean-Marie Henry (Commissariat à l'Énergie Atomique, Saclay, France). Métaux (Corrosion-Inds.) No. 397, 10p. (1958) Sept. (In French)

The uranium-molybdenum diagram was established by differential thermal analysis up to 30 at.% Mo (about 15% by weight), and a study of the kinetics of decomposition of several alloys in the metastable γ phase was made. This phase was maintained at low temperature in alloys with a high molybdenum content (greater than 5% by weight). The samples, placed in sealed ampules, underwent stepwise annealing of a solid solution of the γ phase in the α + ε stability region. The techniques used to follow the transformation consisted of dilatometry, resistivity, hardness testing, and metallography. For a given temperature, the starting time of the transformation increased with the molybdenum concentration. For example, at 500°C, it was 9 min for 5.4% in weight, 3 hr for 8%, and about 40 hr for

12%. An interpretation of the mechanism of decomposition is given, based on a fuller study carried out on the alloy U−5.4% Mo. (auth)

23348

POSITIONS OF THORIUM AND URANIUM IN THE PERIODIC TABLE. A. E. Dwight (Argonne National Lab., Ill.). Nature 187, 505-6(1960) Aug. 6.

During the course of a continuing investigation of the alloy behavior of Sc and Ti group elements, it was noted that Th and U behaved as if they were members of the Ti group. Their crystal structure in intermetallic compounds was similar to that of members of the Ti group. U was found to bear little resemblance to Mo of the Cr group, as was earlier postulated. The concept in which both Th and U were considered members of the Ti group was not inconsistent with the hypothesis that Th, not Ac, is the parent element of the heavy-metal series. A radial periodic table was developed which showed Th in a dual role, first as a member of the Ti group, and second, as the parent of a thoride series. (M.C.G.)

23349

URANIUM CARBIDE AS A FUEL. A REVIEW OF CURRENT KNOWLEDGE. A. Strasser (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Eng. 5, 353-7(1960) Aug.

A review is given of current information on the compatibility of UC as a reactor fuel. A comparison is made of fuel costs for fast breeder reactors using fuels of U-10% Mo, UC, PuC-UC, and PuO_2-UO_2. A "data sheet" is included which tabulates the physical and mechanical properties and the chemical reactivity of UC. The reaction behavior of solids, liquids, gases, and organic coolants with UC is included. Phase diagrams are given for the C−C, C−N−U, BeC−UC, and the ThC−UC−ZrC systems. 77 references. (B.O.G.)

23350

NIOBIUM—PROMISING HIGH-TEMPERATURE REACTOR-CORE MATERIAL. J. A. DeMastry and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 18, No. 9, 87-90; 132; 134(1960) Sept.

The properties of niobium and niobium-base alloys were studied for high temperature reactor use. Results indicated that niobium-based, enriched-uranium alloys may be valuable as fuels for use at 1600 to 2000°F in a nonoxidizing environment. The properties of unalloyed niobium, capture cross sections, high temperature strengths, effects of cold work on hardness, electrical resistivity of annealed alloys, tensile properties, creep and creep rupture properties, oxygen solubility, and the effects of oxygen on tensile strength were investigated for niobium and its alloys. Hot-hardness values were obtained for niobium-uranium alloys. Rolling and forging tests indicated that the 20 wt.% alloy was most easily forged. Corrosion tests were conducted in air, CO_2, NaK, water, and steam. Data obtained indicated that the niobium-20 wt.% uranium alloy was the best metallic fuel yet developed for high temperature use. (M.C.G.)

23351

NOTE ON THE VISCOSITY OF N_2−CO_2 MIXTURES. S. Weissman and E. A. Mason (Univ. of Maryland, College Park). Physica 26, 531-2(1960) July. (In English)

At 20°C and pressures from 1 to 21 atm., mix levels of N_2−CO_2 exhibited positive deviations from a linear mixing rule. Their thermal conductivity also showed unusual positive deviations from linearity at high temperatures. Both thermal conductivity and viscosity were correlated with the experimental binary diffusion coefficients by relations from the rigorous kinetic theory of gases without the introduction of a specific intermolecular force law. The viscosity of N_2−CO_2 mixtures was calculated at 20 and 825°C using three sets of diffusion coefficients. Deviations from linearity for both thermal conductivity and viscosity appeared to arise from the same sources as the abnormalities of the diffusion coefficients. (M.C.G.)

23352

URANIUM ALLOYS WITH LOW AND MEDIUM AMOUNTS OF ADDITIVE ELEMENTS. M. Englander (Commissariat à l'Énergie Atomique, Saclay, France). Rev. met. 55, 177-87(1958). (In French)

The most economical source of recuperable heat in a reactor consists of metallic uranium, either in its natural state or slightly enriched in U^{235}. It is used in large quantities in the form of rods of 20 to 40 mm diameter, which are subjected to a series of irreversible distortion stresses. In view of the technological properties of fuel material made up of uranium of nuclear purity (whether in the rough-cast state, extruded or heat treated), metallurgical and nuclear considerations led to the experimental development of certain uranium alloys which show much better resistance to thermal and nuclear strain than does pure uranium metal. (auth)

23353

ON THE INFLUENCE OF ILLUMINATION UPON THE INTENSITY OF X-RAY REFLECTIONS FROM A CADMIUM SULFIDE CRYSTAL. M. A. Rumsh, Yu. N. Shuvalov, and L. A. Smirnov (Leningrad State Univ.). Soviet Phys.-Solid State 2, 341-2(1960) Aug.

The influence of illumination upon the intensity of x-ray reflections from a CdS crystal was investigated. When the angle between the light beam and x-ray beam was very close to 120°, the light beam reflected from the plane (110) coincided with the x-ray reflection from plane (210). In this process the temperature of the paper and film rose by 5 to 6°. A study of the influence of temperature on the sensitivity of the film indicated that a 1° change in temperature increased the blackening density by 1.5%. The x-ray structural studies of single CdS crystals that showed noticeable changes in the relative intensities of the first reflected x rays for strong crystal illumination reflected experimental conditions rather than changes in crystal properties. (M.C.G.)

23354

ON THE QUESTION OF THE MAGNETIC SUSCEPTANCE OF METALLIC LITHIUM. A. G. Samoilovich and M. V. Nitsovich (Czernowitz State Univ., Academy of Sciences, USSR). Soviet Phys.-Solid State 2, 343-5(1960) Aug.

The magnetic susceptance of metallic lithium was investigated because experimental results did not agree with theoretical predictions. Since Li has a body-centered cubic lattice its susceptance is a scalar and may be represented by the $X = X_1 + X_2 + X_3 + X_4 + X_5$. The first four terms give the diamagnetic contribution to the total expression for the orbital magnetic susceptance. The value obtained for total diamagnetic susceptance was −0.294. The fifth term is a generalization of the so-called Van Vleck paramagnetism for the case of electron motion in a crystal. It plays a decisive role in explaining the anomalous susceptance of metallic lithium. (M.C.G.)

23355

INVESTIGATION OF THE THORIUM−YTTRIUM SYSTEM. D. T. Eash and O. N. Carlson (Ames Lab., Ames, Iowa). Trans. Am. Soc. Metals 52, 1097-1114(1960).

The thorium-yttrium alloy system was investigated by thermal, electrical resistance, x-ray, and microscopic methods. On the basis of the data obtained from this investigation a high temperature body-centered cubic allotrope of yttrium was identified above 1490°C. A region of complete solid solubility occurs at elevated temperatures in this system and an eutectoid at 1375°C and 25 wt.% yttrium. The solid solubility limits of the α thorium and α yttrium regions are approximately 20 and 30 wt.% yttrium, respectively. (auth)

23356

PERFECTION OF THE ALUMINUM LATTICE. M. E. Straumanis and T. Ejima (Missouri School of Mines and Metallurgy, Rolla). Z. physik. Chem. (Frankfurt) (N. S.) 23, 440-8(1960) Mar. (In English)

The actual number, n′, of atoms per unit cell in two kinds of Al of differential purity was calculated from lattice constant and density measurements. It was found that n′ in 99.9998% Al is below 4.00044, the error limit being ±0.00044, and the lattice of purest, undeformed Al should, therefore, be regarded as sound. The less pure +99.99% Al showed a contracted lattice and an increase in density, from which n′ = 4.0018 was found. This implied the presence of $2.7 \cdot 10^{19}$ excess atoms cm^{-3}, or 0.045 wt.%. It is shown that this result was obtained because of formation of impurity segregations in the less pure metal. However, the presence of a small amount of interstitial atoms in the lattice of Al is not entirely excluded. The data obtained with the two Al samples are as follows: lattice constants 4.04958 ± 0.000025 (purest Al) and 4.04947 ± 0.00004 A (25°C); densities 2.69808 ± 0.00009 and 2.6993 ± 0.0005, (25°C). (auth)

23357

THERMODYNAMIC PROPERTIES OF THE SOLID SYSTEM ALUMINUM–ZINC. H. Corsepius and A. Münster (Universität, Frankfurt am Main). Z. physik. Chem. (Frankfurt) (N. S.) 22, 1-19(1959) Oct. (In German)

A new determination of the thermodynamic functions of the solid system Al–Zn between 300 and 400°C in the range 0 to 60 at.% Zn is reported. The results are discussed and compared with the older measurements. It is shown that the statistical theory of lattice models with the assumption of a temperature-independent interaction parameter is not applicable systematically. If the interaction parameter is taken as a function of the temperature, the principal difficulty then arises. A quantitative reproduction of the thermodynamic properties over the region studied is, however, not possible. (tr-auth)

23358

THE PROPERTIES OF METALLIC SOLUTIONS. VI. THE EFFECT OF INDIUM AND GERMANIUM ADMIXTURES ON THE SURFACE TENSION AND MICROSTRUCTURE OF TIN. N. L. Pokrovskii and D. S. Tissen (Moscow State Univ.). Zhur. Fiz. Khim. 34, 1238-42(1960) June. (In Russian)

The surface tension of tin and its solutions with indium and germanium at concentrations of 0.4 to 2.4 at. % was studied at 250 to 500°C by the maximum bubble pressure method. Two specimens of tin were employed. One was obtained by zone melting purification, the other was obtained by prolonged heating in a vacuum at 1000°C. Both types were found to have the same surface tension within the limits of experimental error. Indium and germanium admixtures did not change the surface tension of liquid tin but they affected its microstructure and the kinetics of its crystallization. The effect depended primarily upon the solubility of the admixtures in the solid tin. (auth)

23359

SOME PROPERTIES OF CRYSTALLINE MODIFICATIONS OF ZrO_2. L. N. Komissarova, Yu. P. Simanov, and Z. A. Vladimirova (Moscow State Univ.). Zhur. Neorg. Khim. 5, 1413-17(1960) July. (In Russian)

Thermogravimetric and x-ray analyses showed that only the tetragonal form of ZrO_2 with lattice parameters a = 5.08 k X and C = 5.16 k X is formed at 290 to 300°C by thermal decomposition of $ZrO_2 \cdot 2H_2O$. At higher temperatures of 350, 400, and 500°C the x-ray lines of the monoclinic form of ZrO_2 could be detected in the samples along with the tetragonal form. The monoclinic form only is obtained at 600, 800, 1000, 1200, and 1300°C. A sample of ZrO_2 calcined at 1000°C was found to have the lattice parameters a = 5.11 k X, b = 5.19 k X, c = 5.29 k X, and β = 80.82°. Thus the crystallization of amorphous ZrO_2 proceeds in two stages on heating slowly. First the metastable tetragonal form of ZrO_2 is formed at 290 to 300°C and then the tetragonal form is converted to the monoclinic form above 400°C. The chemical reactivity of the samples was determined by noting the amount of ZrO_2 dissolved in 50 ml of 6 N HCl, 9 N H_2SO_4, or 18 N H_2SO_4 after boiling four hr. The reactivity of the tetragonal form of ZrO_2 was significantly greater than that of the monoclinic form. (TTT)

23360

THE PREPARATION OF INDIUM ANTIMONIDE OF A HIGH DEGREE OF PURITY. M. S. Mirgalovskaya and L. I. Matkova. Zhur. Neorg. Khim. 5, 1551-4(1960) July. (In Russian)

Zone melting was found to be an effective method of purifying InSb. The elements zinc, magnesium, and gallium concentrate at the initial end of the sample and tin, lead, and silicon concentrate at the other end. There is no separation of tellurium. This behavior is in agreement with literature data on the distribution coefficients of these impurities. The rate of melting was 8 to 10 mm/hr. Coarse-grained crystals of InSb prepared from spectroscopically pure indium and antimony were obtained by zone melting with mobility μ = 82,500 cm^2/volt-sec, resistivity ρ = 0.01 ohm-cm, Hall coefficient R = −700 cm^3/coulomb, and carrier concentration n = 1.0×10^{16} cm^{-3}. Additional purification of InSb was attained in preparing single crystals by the method of Chokhral'ski by pulling a growing crystal from a stirred melt. The pull rate was 0.7 to 0.8 mm/min; the rate of rotation of the seed was 3 to 4 rotations per minute, and the rate of rotation of the crucible was 4 to 5 rotations per minute. These single crystals had a μ = 50,000 cm^2/volt-sec, ρ = 0.01 ohm-cm, R = −550 cm^3/coulomb, and n = 1.3×10^{16} cm^{-3}. (TTT)

23361

MATERIALS AND FUEL ELEMENT DEVELOPMENT FOR THE MGCR AND HTGR HELIUM-COOLED REACTORS. M. T. Simnad and W. P. Wallace (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.171-89 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

A general review was made of research and development work on materials and fuel elements for the Marine Gas-cooled Reactor and the High-temperature Graphite Reactor. Although both of these reactors are helium-cooled, there are radical differences in the core design, therefore, separate research work is required for each reactor. The principal problems associated with the non-fuel materials include the choice of materials with adequate creep resistance at high temperatures, corrosion resistance to impurities in the coolant gas stream, and absence of carburization in the presence of graphite. The possibilities of using impervious graphite as cladding material were discussed in some detail. The fuel element program for the MGCR included studies on ceramic dispersion type fuels. The HTGR fuel consists of dispersions of uranium carbide and thorium carbide in graphite. The problems associated with the development of these fuel elements and the results of the experiments in progress were presented. (auth)

23362
DEVELOPMENT OF SPHERICAL URANIUM—GRAPHITE FUEL ELEMENTS. Lincoln D. Stoughton (Sanderson & Porter, New York). p.200-26 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

The various types of spherical uranium-graphite fuel elements being developed for the Pebble-bed Reactor were described. Fissile and fertile materials are incorporated in the 1.5-in.-dia spherical graphite matrix by infiltration, admixture, or lumping. The diffusion of fission products is retarded by carbonaceous or metal carbide coatings on the surface of the sphere and/or by ceramic coatings on individual fissile particles. Experimental results on the diffusion rates of fission products at high temperatures and the effects of irradiation on physical characteristics of the fuel elements were described. (auth)

Radiation Effects

23363 AD-236496
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
GAMMA IRRADIATION OF GERMANIUM P-N JUNCTION DIODES WITH CONTROLLED AMBIENTS (thesis). Gustav J. Freyer. Mar. 1960. 56p.

The reverse current-voltage characteristics of Ge diodes were investigated in wet and dry ambients during gamma irradiation. Electrolytically etched p-n junction diodes were exposed to ambients of O and varying amounts of H_2O vapor. In dry O the radiation caused a sharp peak in the current-voltage characteristic. The peak current was two orders of magnitude greater than the non-irradiation current. One diode exhibited a large current oscillation at the peak voltage. As the ambient was cycled to wet O there was an initial sharp decrease in current followed by an increase to a final value. At high humidities the peak disappeared and the current saturated at a value slightly less than that obtained in the same ambient without radiation. The results are discussed in terms of bulk and surface properties. (auth)

23364 AE-29
Aktiebolaget Atomenergi, Stockholm.
SOME GENERAL REQUIREMENTS FOR IRRADIATION EXPERIMENTS. H. P. Myers and R. Skjöldebrand. May 1960. 11p.

The use of reactors for materials research and testing is reported. Considerations of chemical effects and problems of coolant technology are excluded. The general requirements for irradiation experiments and the reactors housing them, facilities for irradiation experiments which are available within the European Atomic Energy Society countries, and possible limitations of these facilities are considered. (auth)

23365 DOFL-TR-849
Diamond Ordnance Fuze Labs., Washington, D. C.
PERFORMANCE OF EMR VOLTAGE-CONTROLLED OSCILLATOR UNITS IN A NUCLEAR ENVIRONMENT. Martin F. Oertel and Charles R. Ashwood. July 29, 1960. 38p. DOFL Project No. 24220.

Tests are being conducted to determine the performance of telemetry equipment in a nuclear environment. As part of this program, a limited number of subcarrier oscillator units designed by Electro-Mechanical Research, Inc. (EMR) were subjected to the environment provided by TRIGA (Training Reactor Isotope General Atomics). For these tests a reactor pulse was used that delivered an integrated neutron flux of approximately 3 to 5×10^{12} nvt. It was found that the center frequencies of modified versions of the EMR Model 75B unit employing pentodes in the multivibrator circuit deviated less during nuclear transient than did similar units with triodes. Based on data taken during over 20 runs and on units operating from 10.5 to 70 kc, the deviation in center frequency is less than 1.5% during the transient provided by TRIGA. The contributions to the total frequency shift for the transient by the multivibrator, d-c amplifier, filament compensator, and screen voltage dependence are discussed, and relations of the contributions of these individual circuits are documented. (auth)

23366 HW-55520
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EXAMINATION OF AN INTERNALLY AND EXTERNALLY COOLED WAFER FUEL ELEMENT GEH-4-14 (RM-155). W. S. Kelly. Mar. 27, 1958. Decl. June 10, 1960. 7p. OTS.

The uranium wafer appeared in good condition after a U^{235} burnup of 0.097 at. %, with no evidence of can wall corrosion. The uneven diameter increases in the individual wafers might cause difficulty in future irradiations. The test sample consisted of one Al-Si bonded (lead dip) slug with a jacket of 1% Ni-Al alloy. (W.L.H.)

23367 JAERI-1010
Japan Atomic Energy Research Inst., Tokyo.
RADIATION STABILITY OF THE RADIATION SHIELDING WINDOW GLASSES. Report No. 10. Akibumi Danno, Kakuji Yamamoto, and Mitsuru Koike. Mar. 10, 1960. 16p.

The optical properties and stability of shielding windows which were installed in a Co^{60} irradiation facility were determined. Measurements showed that indices and densities of the glass did not change with irradiation of 1.2×10^{8} r. (C.J.G.)

23368 JPL-TR-32-20
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
CALCULATION OF ELECTRON DRIFT VELOCITY AND MEAN ENERGY BASED ON "COLLISION TIME" APPROXIMATION. Ching-Sheng Wu. July 5, 1960. 11p. Contract NASw-6.

The problem under study is the calculation of the electron drift velocity and mean energy based on the distribution function discussed previously. Because of the complexity of integration, the approximation of constant collision time is employed and will result in considerable mathematical simplification. The drift velocity as calculated is consistent with the result derived by simple theory. In the calculation of electron mean energy, it is shown that the kinetic energy due to drift motion is small compared to the thermal energy. (auth)

23369 NP-9007
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST 38 [ON RADIATION EFFECTS DATA]. Aug. 15, 1960. 28p. Project No. 2133. Contract AF33(616)-7375.

Abstracts of 89 papers pertaining to radiation effects on electronic systems, polymeric materials, fuels, lubricants, hydraulic fluids, ceramic materials, chemicals, metals, and alloys are presented. Abstracts on dosimetry, irradiation facilities, and space radiation are included. (C.J.G.)

23370 WADC-TR-59-618
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECTS OF RADIATION ON OXYGEN DESIGNED FOR HUMAN CONSUMPTION. John F. Kircher, Justin S. McNulty, James L. McFarling, and Arthur Levy. Aug. 15, 1959. 38p. Project No. 7165. Contract AF33(616)-5659. (AD-232477). OTS.

Both liquid and gaseous aviator's breathing oxygen, contained under controlled pressure and temperature in stainless steel vessels, was subjected to gamma irradiation. The rate of ozone formation in liquid oxygen was nearly constant to 5.9×10^8 ergs/g (C), the maximum dose used in these studies. Ozone formed during irradiation of gaseous oxygen, reached a maximum concentration at about 3×10^7 ergs/g (C) and decreased to an equilibrium concentration at about 10^9 ergs/g (C). The ozone yield appeared to be independent of pressure and dependent upon temperature and dose rate. There were marked increases in the ozone yield with decreasing temperature and with increasing dose rate. In mixed-field irradiations, induced radioactivity due to argon-41 was found. The equilibrium activity was 10 to 14×10^{-5} microcuries per cc. (auth)

23371
ABSORPTION PROPERTIES OF RADIO PROTECTIVE GLASSES. W. Jahn (Jenaer Glaswerk Schott & Gen., Mainz). Atompraxis 6, 168-70(1960) Apr.-May. (In German)

Irradiation processes in hot cells can be directly observed with the aid of radiation-absorbing glasses. On account of undesirable changes which may appear in the glasses as a result of γ radiation, an exact determination of the extent of discoloration in such glasses is necessary. In addition, a large number of other characteristics must be known; e.g., natural color, reflection, the absorption coefficient in regard to γ radiation and build-up factors. These data were determined by irradiation experiments, measurements, and calculations; they are given in this article in the form of graphs and tables. (auth)

23372
INFLUENCE OF IRRADIATION OF GERMANIUM BY ALPHA PARTICLES ON THE CARRIER RECOMBINATION. Gerhard Dorda (Karlov Univ., Prague). Československ. časopis pro fysiku 8, 326-30(1958). (Translated from Referat. Zhur. Fiz. No. 6, abstract No. 13404).

An investigation was made of the effect of α irradiation on surface recombination in crystals of germanium. The irradiation was carried out in air. An approximate calculation showed that the position of the energy level of the center of recombination, which rises upon irradiation, lies near the upper edge of the valence band or near the lower edge of the conduction band. The effective recombination cross section was calculated and found to be approximately 3×10^{-12} cm^2.

23373
ON THE HEMATOPORPHYRIN RADIOLABILITY IN AQUEOUS SOLUTIONS. E. Lazzarini and A. Piscitelli (Istituto di Fisica del Politecnico, Milan). Energia nucleare (Milan) 7, 551-4(1960) Aug. (In English)

The hematoporphyrin radiolability in some acidic media under Co^{60} γ ray irradiation was studied. The radiation yield depends on pH, on hematoporphyrin initial concentration, and on irradiation time for sulfuric and nitric acids. In hydrochloric acid in the range 0.025 to 1.2 N, the yield is constant with hematoporphyrin initial concentration and with irradiation time. (auth)

23374
IRRADIATION EFFECTS IN MAGNETIC MATERIALS. E. I. Salkovitz (Naval Research Lab., Washington, D. C.). J. Metals 12, 622-5(1960) Aug.

The effects of nuclear environments on magnetic materials were investigated. It was demonstrated that there are magnetic materials which are radiation resistant but do not have exciting magnetic properties and are stable to most treatments. The alloys which have enhanced magnetic properties, such as the permalloys, are very susceptible to irradiation. It was possible to inhibit damage in some cases and to produce better magnetic materials. Radiation studies may be used as a physical tool to study materials in magnetic states hitherto unobtained in some of the materials. (B.O.G.)

23375
EFFECTS OF RADIATION ON STRUCTURAL MATERIALS. S. I. El-Sisi (Assiut Univ., Egypt). Nuclear Energy, 365-8 (1960) Aug.

The different effects of irradiation on structural materials are of considerable interest to designers, engineers, and others working in the nuclear energy field. A survey is given of research studies undertaken in this field. It is not in any way intended to be comprehensive, but merely a guide as to the most important and impressive investigations. (auth)

23376
TECHNIQUES FOR THE IRRADIATION OF CERAMIC FUELS IN A MODERATE THERMAL NEUTRON FLUX. William G. Blessing (Instituto Venezolano de Investigaciones Cientificas, Caracas). Nuclear Sci. and Eng. 8, 105-11(1960) Aug.

The physics calculations required to determine power, heat flux, and burnup for ceramic fuel materials as a function of variables such as fuel radius, enrichment, reactor thermal neutron flux, and irradiation time are considered. It is demonstrated that high fuel burnups may be obtained using moderate thermal neutron flux by proper choice of variables. Heat transfer calculations utilizing the thermal resistance concept for a specific capsule design are described, together with an analysis of the design and operational uncertainties. (auth)

23377
RELAXING RELIANCE ON EMPIRICAL DATA. Douglas S. Billington (Oak Ridge National Lab., Tenn.). Nucleonics 18, No. 9, 64-7(1960) Sept.

With the experimental tools and basic theoretical framework now available, it is no longer necessary to rely on empirical knowledge alone. To study discrepancies between theoretical and actual radiation damage, experiments were carried out at extremely low temperatures to lessen recombination of vacancies and dislocated atoms. Transmutation effects of thermal neutrons, gas formation in Be and Mg, and swelling of control rods and fuels were studied. Fast neutron irradiation was found to accelerate solid-state reactions in many materials considered important for reactor applications. Brittle fracture of pressure vessels was investigated. The high temperatures in advanced reactors caused new studies of creep, fatigue strength, and behavior of refractory materials. Experiments were based on the newest solid-state theories. (M.C.G.)

23378

RADIATION EFFECTS ON REACTOR METALS. David O. Leeser (Atomic Power Development Associates, Inc., Detroit). Nucleonics 18, No. 9, 68-73(1960) Sept.

Radiation induced changes in metal core structures and vessels are affected by material purity, grain size, temperature, stresses, and stress cycles. Neutron irradiation of two high-alloy ferritic steels produces increased yield stress and tensile strength but causes a decrease in elongation. Fine grain size increases the resistance of the steel to radiation effects. The low-carbon steels have less uniform ductility after exposure. Stainless steels offer the advantages of higher initial ductility and lack of entirely brittle failure. Hardness and tensile strength increases up to a certain maximum exposure. Evaluation of welded structures was made under high neutron doses at various temperatures. Radiation effects on cladding materials and light metals such as zirconium, aluminum, beryllium, molybdenum, and niobium were studied. Control materials were also investigated and the results reported. (M.C.G.)

23379

RADIATION PULSES AND ELECTRONICS. John W. Clark and Thomas D. Hanscome (Hughes Aircraft Co., Los Angeles). Nucleonics 18, No. 9, 74-7(1960) Sept.

Radiation pulses acting on electronic components may produce either permanent or transient effects. These effects can be attributed to two phenomena. These are ionization and atomic displacements. Permanent effects are usually caused by displacements; transient effects most often occur as the result of ionization. Two kinds of transients are produced. These are the noise transient, which is a pulse induced in the circuit by any of the radiation-effect mechanisms, and the transient of the distortion of normal signals, which is due to a temporary change in operating characteristics. The various ways in which transient radiation effects show themselves were studied in resistors, capacitors, semiconductor diodes, transistors, infrared detectors, gas tubes, and coaxial cables. (M.C.G.)

23380

RADIATION EFFECTS ON ORGANIC MATERIALS. James G. Carroll and Robert O. Bolt (California Research Corp., Richmond). Nucleonics 18, No. 9, 78-83(1960) Sept.

Crosslinking, or polymerization, and cleavage are the chief radiation effects on organic compounds. In a study of lubricants, the stability of the base oil was the most important aspect of radiation resistance. Polyphenyl ethers and alkyl aromatics were the chief lubricants studied. The success of the organic coolant used in OMRE encouraged further research into the nature of radiolysis products as a basis for applying advanced chemical and physical separation schemes to degraded coolants. Crosslinking increased the tensile strength, hardness, and elastic modulus of plastics, while cleavage had the opposite effect. The major effects observed after irradiation of polyethylene were hydrogen evolution, crosslinkage, increased unsaturation, destruction of crystallinity, and color changes. Methacrylate polymers were found to cleave on irradiation. The most significant development in the study of radiation effects on elastomers was the use of additives (antirads) to produce radiation-resistant rubbers. Rubbers vulcanized by irradiation were studied because of their high resistance to aging. (M.C.G.)

23381

EFFECTS OF γ-RAY AND NEUTRON IRRADIATION ON THE PYROLITIC CARBON FILM RESISTORS. Tatto Nakai and Takeshi Sakakibara. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 54, 88-96(1960) Mar. (In English)

Various kinds of pyrolitic carbon film resistors were exposed to γ irradiation with Co^{60} and neutron irradiation, and the change of their electric properties was measured. The resistance of all samples increased with the increase of radiation dose, and the characteristic difference based on the types of the samples was observed and discussed. The change of the temperature coefficient of resistance connected with the above phenomena was measured and the prominent effects of the surrounding gases were pointed out. The current noise characteristics were investigated; consistent results with the other experiments were obtained. The important role of the atmospheric gases was also emphasized. (auth)

23382

THE EFFECTS OF NEUTRON BOMBARDMENT ON LITHIUM FLORIDE CRYSTALS. E. V. Kolontsova and M. I. Zhestovskaya (Moscow State Univ.). Soviet Phys.-Cryst. 5, 48-53(1960) July-Aug.

Selective etching and X-ray diffusion scattering were used to examine LiF crystals that were given doses ranging from 7.8 · 10^{17} to 5 · 10^{18} n/cm^2. The crystals split up into fragments bounded by planes of (100) type. Regions differing in orientation from the parent crystal were produced. (auth)

23383

THE EFFECT OF IONIZING RADIATION ON THE KINETICS OF THE OXIDATION AND IGNITION OF BUTANE. I. FORMAL KINETICS. N. A. Slavinskaya, S. A. Kamenetskaya, S. Ya. Pshezhetskiĭ, and L. A. Vasil'ev (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 34, 1169-75(1960) June. (In Russian)

The effect of irradiation by fast electrons on the kinetics of chain oxidation and ignition of butane was investigated. Irradiation results in a fall of the induction period and in the effective activation energy of the oxidation reaction from 46 to 15 kcal/mole, depending upon the radiation intensity. Analysis of the data on the basis of Semenov's branching chain theory showed that the radiation effect is due to the electron initiated formation of primary active centers for the chain oxidation reaction. Corresponding to the acceleration of the oxidation reaction, radiation decreases the induction period of ignition as well as the ignition temperature. (auth)

23384

METHOD OF RESISTING RADIATION DAMAGE TO ORGANIC FLUIDS AND COMPOSITIONS THEREFOR. (to United States Atomic Energy Commission). British Patent 844,781. Aug. 17, 1960.

Additives for improving the radiation resistance of organic fluids and lubricants are discussed. Two new classes of additives were found to reduce markedly the tendency of lubricants to thicken and become viscous with irradiation. Alkyl styrene polymers, especially those with lower alkyl substituents, have a beneficial effect on the viscosity change with irradiation which is attributed to their ability to absorb radiation energy without breaking down. Usually the alkyl group is substituted in the α position to produce oil-soluble polymers, and their concentration in the mixture can be 10 to 40 % of the base oil. Viscosity-index improvers that decrease the viscosity when irradiated include polymerized acrylate esters, methacrylate derivatives having long-chain alkyl substituents, styrene and olefin copolymers, liquid polymers of iso-olefins, polymerised vinyl ethers, and polyethers. Additives are usually employed in concentrations of 2 to 20 % of the base oil. The role of other additives, e.g., antioxidants, metal deactivators, and free-radical scavengers, and the kind of oils that can be improved by the above additives are discussed; synthetic lubricating oils, e.g., alkyl aromatics, are preferred. (D.L.C.)

PHYSICS

General and Miscellaneous

23385 AD-236499
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
X-RAY ABSORPTION COEFFICIENTS FOR UNIQUE MATERIALS (thesis). Francis Joseph Janik, Jr. Mar. 1960. 45p.

The x-ray mass-absorption coefficients of a phenolic nylon resin and Haynes-25 alloy were measured at 5 to 20 kev. A single-crystal x-ray-diffraction unit with a G-M detector was used for the 6.4 to 20 kev region. Another single crystal x-ray-diffraction unit with a scintillation detector and a helium path was used for the 5 to 12 kev region. Monochromatic radiation was obtained by using the K_α, K_β, and L_β lines of a number of different targets. Two methods of calculating mass-absorption coefficients were evaluated and found satisfactory for use at 1 to 60 kev. (auth)

23386 AFOSR-TN-60-548
Johns Hopkins Univ., Baltimore.
A DETERMINATION OF BACKGROUND RADIATION AND THE EFFECT OF SHIELDING. H. F. Perry and A. Pevsner. June 1960. 12p. Contract AF18(603)-143.

An investigation of the background radiation, in particular that due to "slow electrons," was undertaken to determine the rate of contamination of undeveloped nuclear emulsions. Unshielded emulsions were found to pick up 4×10^5 tracks/cm^3/day in the 35-200 kev energy range. In a specially constructed iron safe the background was reduced and emulsions picked up only $.09 \times 10^5$ tracks/cm^3/day. Under the shielded conditions, the latent images faded at a faster rate than the background was acquired. (auth)

23387 AFOSR-TN-60-657
General Electric Co. Flight Propulsion Lab. Dept., Cincinnati.
THERMODYNAMIC AND ELECTRICAL PROPERTIES OF MERCURY VAPOR AT PRESSURES BELOW ATMOSPHERIC AND HIGH TEMPERATURES. Technical Note [covering Period] February 1, 1959 to February 28, 1960. A. Sherman and F. Martinek. 43p. Project No. 9781. Contract AF49(638)-243.

The thermodynamic properties of mercury were calculated at temperatures up to 15,000°K and at pressures between 1 and 10^{-4} atmospheres. The electric conductivity was also calculated in the presence and absence of a magnetic field. Results are presented graphically. (J.R.D.)

23388 AFOSR-TN-60-792
Illinois Inst. of Tech., Chicago.
DISTRIBUTIONS OF ELECTRONS IN CADMIUM SULFIDE CRYSTALS. Ganesh P. Mohanty and Leonid V. Azároff. July 19, 1960. 8p. Contract AF49(638)-425.

The (0001) electron density projections were determined for a pure CdS crystal having a high dark resistivity and one doped with chlorine having low resistivity. Accurate intensities (±2%) were obtained so that small variations in the electron distribution could be determined. It was found that the atoms in the doped crystal had larger effective sizes than in the undoped crystal. Also, the presence of a very small peak in an interstitial position of the structure suggests that some of the atoms occupy interstitial sites. This result differs markedly from an earlier investigation by Shuvalov who reports the formation of "electron bridges" between adjacent atoms in CdS crystals having low dark resistivities. The results obtained in this investigation also differ from Shuvalov's in regard to variations in diffraction intensities of certain reflections. Possible reasons for these differences are discussed. (auth)

23389 AFOSR-TN-60-701
Atlantic Research Corp., Alexandria, Va.
SOLID-PROPELLANT SOURCE OF CESIUM PLASMA. Lawrence W. Fagg and Raymond Friedman. June 23, 1960. 4p. Project No. 4766. Contract AF49(638)-651. (AD-239696).

An investigation of the combustion characteristics and ion and electron density obtainable by burning mixtures of $CsClO_4$: Al and $CsNO_3$: Al is discussed. Thermodynamic equilibrium calculations made with an IBM-704 for stoichiometric $CsNO_3$: Al and $CsClO_4$: Al are presented which give the temperatures and the percentages of the significant ion species for three pressure and two pressure expansions. (W.D.M.)

23390 AFOSR-TN-60-802
Weizmann Inst. of Science, Rehovoth, Israel.
MANY BODY PERTURBATION METHODS IN A SOLUBLE MODEL. Technical Note No. 2. Amnon Katz. Mar. 1, 1960. 54p. Contract AF61(052)-337.

A summation of all Goldstone diagrams is carried out in a soluble model. When the system is superfluid, it is possible to get a correct description of it by continuing the Goldstone series analytically from its region of convergence. Diagrams with "wrong" statistics are most important in this process. (auth)

23391 ARGMA-TN-1C1N-25
Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
RESEARCH LABORATORY QUARTERLY RESEARCH REVIEW NO. 25 FOR FEBRUARY 1, 1960–APRIL 30, 1960. June 1, 1960. 73p.

The supporting research activities of the research laboratory are described. Subjects covered are materials, nuclear physics, fuels and combustion, solid state research, physical electronics, and high-temperature physics. (For preceding period see ARGMA-TN-1C1N-24.). (W.L.H.)

23392 BM-RI-5636
Bureau of Mines, Albany, Ore.
X-RAY CRYSTALLOGRAPHY OF BORON. Raymond L. Carpenter and Haruo Kato. Jan. 1958. 11p.

X-ray-diffraction analysis of fused boron revealed the structure to be rhombohedral. (C.J.G.)

23393 INSJ-30
Tokyo Univ. Inst. for Nuclear Study; Yamanashi Univ., Kofu, Japan; and Kinki Univ., Fuse-City, Japan.
OBSERVATION OF HIGH-ENERGY JET SHOWERS AND HIGH-ENERGY γ-RAYS BY MEANS OF LARGE EMULSION CHAMBERS. Y. Fujimoto, S. Hasegawa, M. Kazuno, J. Nishimura, K. Niu, and N. Ogita. May 13, 1960. 22p.

Two large emulsion chambers were constructed and exposed to cosmic radiation at the Mt. Norikura Laboratory (2740 m) from Sept. 1958 to Feb. 1959. Basic design of the chambers is shown and the results of observations on high-energy jet showers and gamma rays are discussed. (W.D.M.)

23394 JPL-TR-32-18
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
POWER ADDITION AND EXTRACTION FROM GAS FLOW BY MEANS OF ELECTRIC WIND. Meredith C. Gourdine. June 1, 1960. 9p. Contract NASw-6.

Progress on a theoretical study of the feasibility of adding or extracting power to or from a blowing gas is reported. The gas carries an excess positive charge and interacts with a strong electric field due to the space charge and/or an applied voltage. (auth)

23395 LMSD-288052
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif. and University of Western Ontario, London.
ABSORPTION COEFFICIENTS OF AIR. R. E. Meyerott, J. Sokoloff, and R. A. Nicholls. Sept. 1959. 96p. Contract AF19(604)-3893. (AD-231435).

Tables of integrated absorption coefficients were evaluated for high-temperature air by summation of the contributions from discrete transitions which are listed in the text. The tables were computed for dry air in the temperature range from 1,000 to 12,000°K at equal energy increments of 0.25 ev (2,016.5 cm^{-1}) in the wavelength range from 1,167 to 19,837 A and for density ratios relative to sea level, ρ/ρ_0, at each order of magnitude from 10 to 10^{-6}. (auth)

23396 LMSD-288087
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
GENERAL RESEARCH IN DIFFRACTION THEORY. VOLUME 1. Nelson A. Logan. Dec. 1959. 359p. OTS.

The study involves a generalization of the ray-tracing techniques of geometrical optics through the introduction of a class of universal functions which can be used to predict the amplitude and phase of an electromagnetic wave reflected or diffracted by a convex metallic surface. These diffraction integrals are generalizations of functions previously used in studies of radio-wave propagation around the earth's surface. The functions are defined as Fourier integrals having combinations of Airy integrals in the integrands. The Airy integrals, and particularly the history of notations for these functions are discussed in considerable detail. The present study differs from other studies in that it emphasizes the role played by the Taylor and Laurent expansions for these functions. The difficult "transition" regions are readily handled by summing certain divergent series by means of classical summation techniques. Asymptotic expansions of radiation fields from slot antennas on a circular cylinder are presented as an example of the application of these integrals. (auth)

23397 LMSD-480817
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
INFLUENCE COEFFICIENTS FOR SPHERICAL SHELLS. B. R. Baker and G. B. Cline, Jr. June 1960. 47p. Contract NOrd-17017.

The differential equations governing the symmetric bending of spherical shells of constant thickness subjected to edge loads are transformed into a form suitable for asymptotic integration. The asymptotic solutions are used to obtain expressions for the influence coefficients of both a spherical cap and the complementary portion of the sphere. The influence coefficients are valid for either shallow or nonshallow spherical shells provided the shells are sufficiently thin. The coefficients are tabulated. (auth)

23398 NASA-TN-D-466
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
A GRAPHICAL METHOD FOR ESTIMATING ION-ROCKET PERFORMANCE. Thaine W. Reynolds and J. Howard Childs. Aug. 1960. 28p. OTS.

Equations relating the critical temperature and ion current density for surface ionization of cesium on tungsten are derived for the cases of zero and finite electric fields at the ion-emitting surface. These equations are used to obtain a series of graphs that can be used to solve many problems relating to ion-rocket theoretical performance. The effect of operation at less than space-charge-limited current density and the effect of nonuniform propellant flux onto the ion-emitting surface are also treated. (auth)

23399 NP-8863
Duke Univ., Durham, N. C.
DUKE MICROWAVE LABORATORY REPORT NO. 29 [FOR] FEBRUARY 1, 1960—MAY 1, 1960. 77p. Project No. R-357-10-6. Contract AF18(600)-497.

With this are bound: A PROPOSED MOLECULAR AMPLIFIER AND COHERENT GENERATOR FOR MILLIMETER AND SUBMILLIMETER WAVES. Walter Gordy and Monroe Cowan. (AFOSR-TN-60-581). OBSERVATION OF π-STARK COMPONENTS IN MICROWAVE SPECTROSCOPY: PRECISION MEASUREMENTS ON HCN. Brojo N. Bhattacharya and Walter Gordy. (AFOSR-TN-60-535). ELECTRON PARAMAGNETIC RESONANCE STUDIES OF CYTOCHROME AND HEMOGLOBIN (IRRADIATED AND UNIRRADIATED). Walter Gordy and Harvey N. Rexroad. (AFOSR-TN-60-580).

A molecular amplifier and coherent generator for millimeter and submillimeter waves are proposed. A parallel plate Stark cell was designed and constructed for the millimeter wave region of the spectrum. With the cell both π and σ Stark components can be observed. High-precision Stark effect measurements were made on the π and σ components of the $J = 0 \rightarrow$ transition of HCN. From these the electric dipole moment of HCN in the ground vibrational state was calculated to be 2.985 ± 0.005 Debye units. Electron paramagnetic resonance studies were made of both irradiated and unirradiated cytochrome and hemoglobin. (For preceding period see NP-8416.) (W.D.M.)

23400 OOR-837.5
Duke Univ., Durham, N. C.
EXPERIMENTS AT LIQUID HELIUM TEMPERATURES. Final Technical Report [for] December 29, 1952 to September 1, 1959. William M. Fairbank. 34p. Contract DA-36-034-ORD-2193.

Physical properties of liquid and solid He^3 and He^4 were determined. The construction of apparatus for use in experimental studies at liquid helium temperatures is discussed. (C.J.G.)

23401 NP-9148
Illinois. Univ., Urbana.
DEVELOPMENT OF PROCEDURES FOR RAPID COMPUTATION OF DYNAMIC STRUCTURAL RESPONSE. Civil Engineering Studies, Structural Research Series No. 171. Final Report. J. W. Melin and S. Sutcliffe. Jan. 1959. 128p. Contract AF33(600)-24994.

Studies were made on the development of rapid, reliable methods of relating the response of structures and structural elements to the blast loads from atomic or nuclear weapons. The major effort on this project was expended on structures which could be satisfactorily idealized as single-degree-of-freedom systems because of their prevalence; however, consideration was also given to those structures that respond to blast loads in more than one mode, i.e., multi-degree-of-freedom systems. (W.L.H.)

23402 ORNL-2961
Oak Ridge National Lab., Tenn.
ON THE CONVERGENCE OF STEADY STATE MULTIRE-

GION DIFFUSION CALCULATIONS (thesis). Arthur C. Downing, Jr. Aug. 30, 1960. 139p. Contract W-7405-eng-26. OTS.

Submitted to Univ. of Michigan.

The basic technique for solving multiregion diffusion problems is the finite difference method. Implicit in this method is the assumption that if the grid size were allowed to shrink to zero, the finite difference solutions would converge to a solution of the differential problem. A formulation of the finite difference problem is described which admits an additive analog of Green's identity. Using this concept it is shown that the grid solutions coverage at interior points to a function satisfying the diffusion equation. The behavior at interfaces was studied. (auth)

23403 SC-4205(TR)
Sandia Corp., Albuquerque, N. Mex.
MAXIMUM MISSILE RANGES FROM CASED EXPLOSIVE CHARGES. R. H. Bishop. July 1958. 56p. OTS.

Curves are calculated and plotted to show maximum missile ranges from TNT charges cased with aluminum or steel of various thicknesses. The maximum initial missile velocity is assumed to be 10,000 fps. General trajectory formulas are derived from which the range may be calculated for any initial missile velocity, as determined from the ratio of the case weight to the explosive weight. (auth)

23404 SCR-193
Sandia Corp., Albuquerque, N. Mex.
HOMOGENEITY OF THE MAGNETIC FIELD OF A HELMHOLTZ COIL. Kenneth D. Granzow. July 1960. 10p. OTS.

A mathematical expression was derived for the magnetic field of a Helmholtz coil. The components of the field were calculated on the IBM-704 for a large number of points. The results are presented in graphical form. (auth)

23405 SRB-60-1
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
MEASUREMENT OF ELASTIC MODULI OF VARIOUS CRYSTAL STRUCTURES. Literature Search. Jan. 1960. 27p.

Sources searched include Science Abstracts A, 1945 to 1955, 1957, and Jan. to Sept. 1958, and Chemical Abstracts, 1956. 87 references. (J.R.D.)

23406 TID-6271
Illinois. Univ., Urbana.
CHANGES IN MACROSCOPIC SHAPE, LATTICE PARAMETER, AND DENSITY IN CRYSTALS DUE TO POINT DEFECTS. Technical Report No. 22. R. W. Balluffi and R. O. Simmons. May 1960. 22p. Contract AT(11-1)-182. OTS.

It is demonstrated that a crystal of arbitrary shape filled with a fine random distribution of centers of dilatation will dilate homogeneously. No elastic approximations are made, and the results should hold for strains of any magnitude. By use of an average and a perfect reference lattice embedded in the strained crystal, it is then shown that the lattice dilatation as measured by x-ray lattice-parameter measurements and by macroscopic dimensional measurements should be the same along any direction when the number of substitutional atomic sites remains constant. Perturbing effects due to x-ray diffuse scattering should cause negligible error in determining the positions of the Laue-Bragg maxima under usual conditions. All results should apply also to the case of thermal dilatation at temperatures up to the melting point. The use of density measurements in the determination of point-defect concentrations is discussed. Experimental data are reviewed. (auth)

23407 UCRL-5781
California. Univ., Livermore. Lawrence Radiation Lab.
STUDY OF ELECTRIC PROPULSION SYSTEMS FOR SPACE TRAVEL. Final Report. Robert H. Fox. Nov. 16, 1959. 175p. Contract W-7405-eng-48. OTS.

A study of the basic problems associated with the use of electrical propulsion systems for space travel was carried out at Lawrence Radiation Laboratory. The emphasis was on large systems capable of manned flight. Powered trajectory studies on various interplanetary round-trip missions showed that the two basic system parameters are the mean exhaust velocity and the ratio of exhaust beam power to the mass of the propulsion plant. The propulsion plant includes the heat source, heat engine, radiators, electrical generator, and thrust system but not the propellant supply or payload. Since there appears to be no difficulty in obtaining the desired exhaust velocity, attention was paid primarily to those problems which affect the specific power. Also, non-conventional approaches to the energy conversion problem were studied. The result of the study was that the two principal parameters determining the specific power are the operating temperature of the energy conversion system and the efficiency of the thrust system. Both must be high. Achieving the required values of these parameters will require basic research in liquid metal corrosion and in the physics of the thrust system. (auth)

23408 AEC-tr-4117
THE OCCURRENCE OF HOMOLOGS AND THE QUANTUM STRUCTURE OF THE ELEMENTS. [PART] II. C. G. Bedreag. Translated from Acad. rep. popûlare Romîne, Filiala Iaşi, Studii cercetări ştiinţ. Chim. 7, No. 2, 1-4 (1956). 7p. JCL.

A periodic table with 20 columns, called the table with long periods (18-20), is reproduced from the second original table of Mendeleev with 17 columns. It is pointed out that all the physical properties of the elements — the spectral properties, density, atomic volume, melting point, boiling point, and magnetic properties — can be normally grouped in the table with 20 columns. (W.D.M.)

23409 AEC-tr-4176
ELECTRIC EMISSION OF CATHODES MADE FROM POROUS METAL. Ya. P. Zingerman. Translated from Trudy Inst. Fiz. Akad. Nauk Ukr. S.S.R. No. 7, 24-34(1956). 13p. JCL or LC.

The electron emission of a cathode made from porous metal in accelerating and retarding electric fields was experimentally investigated within a low temperature range. The results of experimental observations lead to the conclusion that the distribution of thermionic electron activity on the surface of cathodes made from porous metal is conspicuously inhomogeneous. The emission constants of cathodes made from porous metal were determined. (auth)

23410 AEC-tr-4199
L EMISSION AND ABSORPTION SPECTRA OF EUROPIUM (63) AND TERBIUM (65). (Spectres L d'Emission et d'Absorption de l'Europium (63) et du Terbium (65)). Paul Sakellaridis. Translated by Gretchen Riese and Robert McDonald (Los Alamos Scientific Lab.) from Compt. rend. 236, 1547-9(1953). 4p. JCL.

In two preceding notes the principal results obtained for holmium, gadolinium, and thulium were given in the course of a study of the L spectra of various rare earths. The results obtained for europium and terbium are presented using the same experimental conditions. (auth)

23411 AEC-tr-4201
THE L ABSORPTION SPECTRA AND ENERGY LEVELS OF NEODYMIUM (60) AND SAMARIUM (62). (Spectres d'Absorption L et Niveaux d'Energie du Neodyme (60) et du Samarium (62)). Pierre Callon. Translated by Gretchen Riese and R. E. Tate (Los Alamos Scientific Lab.) from Compt. rend. 240, 615-17(1955). 4p. JCL.

The systematic analysis of the L absorption spectra of neodymium and of samarium in the oxide state is presented. Energy levels of these elements are calculated. (auth)

23412 CEA-tr-R-818
SPECTRE ÉNERGÉTIQUE DU GAZ DE FERMI NON-IDÉAL. (Energy Spectrum of a Non-ideal Fermi Gas). V. M. Galitzkii (Galitzky). Translated into French from Zhur. Ekspt'l. i Teoret. Fiz. 34, 151-62(1958). 23p.

The energy spectrum and fundamental state energy of a Fermi nonideal gas with a positive potential for particle interaction were determined. The first two terms of the development were obtained according to the values of the ratio of the size of the field of effect to the potential at the average distance between particles (approximation for gas). (tr-auth)

23413 JPRS-2819
Joint Inst. for Nuclear Research, Dubna, U.S.S.R.
THE JOINT INSTITUTE OF NUCLEAR RESEARCH AT DUBNA. (Ob'yedinennyĭ Institut Yadernykh Issledovaniĭ v Gorode Dubna). (Translation). A. M. Ryzhov. 1958. 41p OTS.

The administration and organization of the Joint Institute are outlined. The facilities and objectives of the five laboratories (High Energy, Nuclear Problems, Neutron Physics, Nuclear Reactions, and Theoretical Physics) are discussed. (W.D.M.)

23414 JPRS-2885
STATIONARY DETONATION. B. V. Voytsekhovskii (Voytsekhovskiy). Translated from Doklady Akad. Nauk S.S.S.R. 129, 1254-6(1959). 7p. OTS.

A stationary-state detonation wave experiment in a ring-shaped channel in which the original gas mixture is continuously fed to a point preceding the front of a detonation wave is described. Structure of the wave front and wave velocity under such stationary conditions are discussed. (C.J.G.)

23415 JPRS-2912
ON AN INERTIAL METHOD OF MEASURING VELOCITIES. V. N. Drozdovich. Translated from Izvest. Vysshikh Ucheb. Zavedeniĭ, Priborostroenie No. 3, 29-39(1959). 14p. OTS.

The systematic errors in velocity measurement caused by Coriolis and centripetal accelerations are examined. The effects of Coulomb friction are discussed. It is concluded that in order to compensate for systematic errors produced by Coriolis and centripetal accelerations, it is necessary to introduce devices to take into account trajectory parameters. Integral correction ensures absence of velocity errors. (J.R.D.)

23416 JPRS-5022
SHOCK WAVES IN SOLIDS. L. P. Orlenko and K. P. Stanyukovich. Translated from Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 6, 14-24(1958). 18p. OTS.

The propagation of shock waves in solids under high pressures is examined. The compressibility of the material involved is considered, and the motion of such material is studied in the zone of an incident shock wave and the reflected wave zone where the body has finite dimensions. The solution is obtained in the form of finite formulas. (J.R.D.)

23417 JPRS-5086
EXAMINATION OF A SYSTEM OF EQUATIONS OF MAGNETIC HYDRODYNAMICS FOR A TWO-PARAMETER CASE. V. S. Tkalich. Translated from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr. No. 1, 182-3(1960). OTS

23418
THERMAL TRANSIENTS IN GRAPHITE-COPPER CONTACTS. J. A. Greenwood and J. B. P. Williamson (Tube Investments Research Labs., Cambridge, Eng.). Brit. J. Appl. Phys. 11, 389(1960) Aug.

Two points in an article by Dr. W. Davis, "Thermal Transients in Graphite-Copper Contacts" are discussed. The equations $\nabla^2\psi = 0$ and $\nabla^2\psi + K\psi = 0$ are considered. The authors conclusion that equipotentials are isothermals is true only in equilibrium. In his discussion of the temperature growth in a graphite contact, the author claims that the position of the warmest section is independent of time. This is shown to be untrue. (M.C.G.)

23419
THE OVERHAUSER EFFECT IN CARBON AND GRAPHITES. Anatole Abragam, André Landesman, and Jacques Michel Winter (Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 247, 1849-52(1958) Nov. 24. (In French)

The Overhauser method considerably increased the nuclear resonance signals emitted by the protons contained in narrow band paramagnetic carbon and C^{13} graphite cores. (auth)

23420
STUDY OF THE RELAXATION IN MAGNETIC RESONANCE BY THE METHOD OF "FORCED TRANSITORY PRECESSION". Ionel Solomon (Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 248, 92-4(1959) Jan. 5. (In French)

The method of forced transitory precession (F. T. P.) offers a means of studying relaxation in solids in the presence of an H. F. field comparable in intensity to the width of the static beam. In liquids it allows the direct measurement of relaxation times T_2, even when they are very long and without perturbations by the inhomogeneities or the derivative of the field. The experimental set-up is described briefly. (auth)

23421
RELAXATION TIMES AND DYNAMIC POLARIZATION TIMES IN THE PRESENCE OF SPIN DIFFUSION. Jacques-Michel Winter (Commissariat à l'Énergie Atomique, Saclay, France). Compt. rend. 249, 2192-4 (1959) Nov. 23. (In French)

Formulas by which nuclear relaxation times in solids can be calculated are verified. Spin diffusion is taken into consideration in these calculations. The influence of this diffusion on dynamic polarization times is also discussed. (auth)

23422
THE EFFICIENCY TRACING TECHNIQUE FOR ELIMINATING SELF-ABSORPTION ERRORS IN 4π β-COUNTING. P. J. Campion, J. G. V. Taylor, and Janet S. Merritt (Atomic Energy of Canada Ltd., Chalk River, Ont.). Intern J. Appl. Radiation and Isotopes 8, 8-19(1960) May. (In English)

The validity of a standardization technique recently described by Merritt et al. in which the advantages of the 4π $\beta-\gamma$ coincidence method in eliminating self-absorption errors are extended to pure β-emitters by the addition of suitable $\beta-\gamma$ "tracer" nuclides was examined in detail. Calculations based on several models for the self-absorption process together with further experimental results supporting the method were presented and compared. The use of these theoretical considerations in making corrections for complex disintegration schemes in coincidence counting was discussed. The application of this "tracer" technique to nuclides having complex disintegration schemes was demonstrated for Rb^{86} and the result used to obtain a value of 8.7 ± 0.2% for the fraction of disintegrations populating the 1.08 Mev level in Sr^{86}. (auth)

23423

ASYMPTOTIC FORMULAS FOR ELECTROMAGNETIC FIELDS OF CYLINDRICAL HETEROGENEITY. B. P. Dyakonov (Inst. of Geophysics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. 7, 954-8(1960) July. (In Russian)

Asymptotic formulas were derived for the anomalous heterogeneity of cylindrical electromagnetic fields that exist underground and extend to considerable distances. (R.V.J.)

23424

WORLD-WIDE EFFECTS OF HYDROMAGNETIC WAVES DUE TO ARGUS. W. K. Berthold, A. K. Harris, and H. J. Hope (Army Signal Research and Development Lab., Fort Monmouth, N. J.). J. Geophys. Research 65, 2233-9(1960) Aug.

The Argus detonations in the ionosphere above the south Atlantic produced geomagnetic disturbances that propagated to almost all parts of the world. The geomagnetic variations, having a quasi-period of 1 to 3 sec were recorded principally by induction-type magnetometers and earth-current stations. Two signals whose indicated velocities were of the order of 3000 and 700 km/sec were found. Amplitudes varied from 5 gammas (Antarctica) down to 0.002 gamma at a large loop in Arizona. The signal strength fell rapidly as the direction of propagation deviated from the geomagnetic meridian. (auth)

23425

AN AUTOMATIC RECORDING REPTOGRAPH FOR PHENOMENA ASSOCIATED WITH MAGNETIZATION ACCOMMODATION. G. Bonnet, D. Dautreppe, and R. Gariod (Centre d'Études Nucléaires, Grenoble, France). J. phys. radium 20, 229-32(1959) Feb. (In French)

Apparatus for studying the transient effects representing magnetization accommodation in a ferromagnetic body is described. The recording process is continuous and can be continued for a duration of 1 second with a precision better than 1%. The cycle of measurement is rendered automatic by a new type of demagnetizing equipment and a programming device. (auth)

23426

THE PHOTOIONIZATION OF H_2 AND THE SPATIAL CORRELATION BETWEEN ELECTRONS. Mikio Shimizu (Tokyo Univ.). J. Phys. Soc. Japan 15, 1440-8(1960) Aug. (In English)

The photoionization of H_2 by photons of sufficiently short wave length produces the molecular ion H_2^+ as well as the atomic ion H^+. The relative yield H^+/H_2^+ was calculated as the function of energies of photons. The description of the ground state of H_2 is given by the superposition of two configurations: $\sigma_g^2 + \lambda\sigma_w^2$, taking account of the spatial correlation between electrons, while those of H_2^+ by the linear combinations of Wang type atomic orbitals. The results show that the relative yield curve has a plateau in the high-energy range and its height is essentially proportional to λ^2. The various approximations used in the calculations (Franck Condon approximation, Born approximation, dipole velocity approximation, the neglect of possibility of production of H_2^+, and H^+ through autoionization and multiple ionization etc.) are carefully discussed. The velocity distribution of the ejected protons was also calculated according to the Franck Condon principle. (auth)

23427

SOME REMARKS ON THE MAGNETOGASDYNAMIC LINEARIZED THEORY. Shigenori Ando (Kawasaki Aircraft Co., [Japan]). J. Phys. Soc. Japan 15, 1523-33(1960) Aug. (In English)

The general theory of magnetogasdynamic linearized flow in extended to cover the case of unsteady flow in an arbitrary direction with respect to the magnetic field. This theory is also valid in the case when the frame is body axes slightly inclined against the free stream direction. For the case of steady flow, quadratic expression for the pressure disturbance is derived. Some problems when weak electromagnetic interaction exists are solved for illustration of the application. (auth)

23428

SENSITIVITY DISTRIBUTION IN PHOTOGRAPHIC EMULSIONS. G. Haase (Universität, Frankfurt am Main). Naturwissenschaften 47, 320(1960). (In German)

Investigations on emulsion layers of homogeneous grain sizes showed that for different grains of the same size class it must be assumed that a sensitivity distribution exists. This sensitivity distribution can not be measured directly; its form can only be inferred from the pattern of the blackening curve. From considerations of the grain size and sensitivity distribution, the relationship for the relative blackening can be determined. From a series of measurement it was concluded that one may assume a log-normal distribution for the sensitivity of the highly sensitive emulsions used. At small grain sizes the sensitivity distribution appears to become narrow. (J.S.R.)

23429

DRIFT VELOCITY OF CHARGED PARTICLES IN THE MAGNETIC DIPOLE FIELD. Manfred Siebert (Universität, Göttingen, Ger.). Naturwissenschaften 47, 351(1960). (In German)

A charged particle which moves spirally around a line of force of a magnetic dipole field is also at the same time deflected perpendicularly to the field. The usual relationship expressing this drift should include a third term dependent on the centrifugal force. This term is derived and the relationship is corrected. (J.S.R.)

23430

REPORT OF THE SCIENTIFIC WORK PRESENTED AT THE XLV NATIONAL CONGRESS OF THE ITALIAN SOCIETY OF PHYSICS. Nuovo cimento (10) 16, Suppl. No. 1, 1-146(1960). (In Italian)

The Inaugural Address and the invited papers given at the National Congress are reported in full. Summaries of the other papers are presented. Abstracts were prepared of five of the invited papers. (J.S.R.)

23431

NUCLEAR RELAXATION IN IONIC CRYSTALS. P. G. De Gennes (Centre d'Études Nucléaires, Saclay, France). Phys. Chem. Solids 7, 345-50(1958). (In French)

In ionic crystals where nuclear relaxation is due to paramagnetic impurities, the part of the total nuclear magnetization which is parallel to the static field obeys a simple relaxation equation. The inverse relaxation time is proportional to: the impurity concentration, the spin diffusion coefficient, and a relaxation length, a, whose exact value depends on the behavior of the nuclear spins in the near vicinity of the paramagnetic impurities. The relaxation rates are modified if the impurities are grouped in clusters or on dislocation lines. (auth)

23432

STUDY OF SUPERFLUIDITY IN LIQUID He BY ION MOTION. F. Reif and Lothar Meyer (Univ. of Chicago). Phys. Rev. 119, 1164-73(1960) Aug. 15.

Ions produced in liquid helium by ionization with α-particles were exploited as microscopic probe particles to study the properties of the superfluid. A time-of-flight method was used to measure directly the drift velocity u of the ions in the liquid for various values of the applied electric field E and at temperatures T down to 0.5°K. The field independent mobility $\mu^{(0)} = u/E$ obtained in the limit of sufficiently small fields increased very rapidly below the λ-point. Its temperature dependence over most of the temperature range below 2°K was of the form $\mu^{(0)} = \alpha \exp(\Delta'/kT)$ and was explained by the scattering of the ions from the collective excitations (rotons) present in the fluid. The nonlinear dependence of u on E at higher field strengths was also investigated; this suggested the possibility of ions creating excitations in the quantum fluid as an important inelastic scattering process at sufficiently large fields. Some additional experiments were suggested. (auth)

23433

IMPURITY CONDUCTION IN TRANSMUTATION-DOPED p-TYPE GERMANIUM. H. Fritzsche and M. Cuevas (Univ. of Chicago). Phys. Rev. 119, 1238-45(1960) Aug. 15.

The Hall coefficient and resistivity of germanium single crystals bombarded with slow neutrons were measured between 1.2 and 300°K. Slow neutron capture and subsequent nuclear transmutation produce majority impurities, gallium atoms, and compensating impurities (arsenic and selenium atoms). p-type samples with a gallium concentration ranging from 8×10^{14} to 5×10^{17} per cc with a fixed compensation ratio of 0.40 were thus prepared and the impurity conduction was studied as a function of the average distance between the majority impurities. The effective radius a of the acceptor ground-state wave function is 90.1 A according to Miller's theory of impurity conduction; it is a = 40 A according to Twose's theory. The latter value agrees well with the effective radius of the Kohn-Schechter acceptor wave function. The activation energy of impurity conduction changes slowly with impurity concentration from 3.5×10^{-4} to 5.9×10^{-4} ev and agrees well with the predictions of Miller's theory for gallium concentration below 5×10^{15} per cc. Measurements on samples which contain different dislocation densities but identical impurity concentrations show that up to 10^4 dislocations per cm^2 do not affect impurity conduction. (auth)

23434

COLLECTIVE OSCILLATIONS AND GIANT DENSITY FLUCTUATIONS. R. Brout (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 5, 193-5(1960) Sept. 1.

Instability in compression modes found by Glassgold, Heckrotte, and Watson (GHW) is related to Overhauser's Hartree-Fock treatment of many-body systems, which predicted a ground state in a Fermi gas with a stationary density fluctuation of a given wavelength. By the use of Overhauser's SCF analysis, it is shown that density fluctuations and GHW instability exist for sufficiently strong attractive interactions, but not for repulsive or weak attractive interactions. The possible application of the results to the theory of He^3 freezing is discussed. (D.L.C.)

23435

PREPARATION OF METALLIC FOILS FROM ISOTOPES. A. D. Bondar, A. S. Emlyaninov, A. P. Klyucharev, L. G. Lishenko, V. N. Medyanik, A. D. Nikolaichuk, and O. E. Shalaeva (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Pribory i Tekh. Ekspt. No. 3, 134-6(1960) May-June. (In Russian)

The preparation of very thin metallic foils of Ni, Co, Cu, Zn, Cd, Mn, Fe, Ag, Cr, Pb, Be, Ge, and Zr to be used as targets in nuclear studies is described. Electrolytic precipitation and evaporation by direct heating and by thermal dissociation are discussed. (R.V.J.)

23436

MEASUREMENT OF SMALL DIFFERENCES IN THE SECOND VIRIAL COEFFICIENT OF GASES AT TEMPERATURE BELOW 0°C. G. Thomaes and R. Van Steenwinkel (Free Univ., Brussels). Rev. Sci. Instr. 31, 825-7(1960) Aug.

An apparatus is described which allows measurements of small differences of the second virial coefficient between two gases at low temperatures (90 to 300°K). (auth)

23437

ON THE DISCHARGE MECHANISM OF PHILIPS IONIZATION GAUGE (P.I.G.). Nobukazu Miyagawa. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 54, 6-15(1960) Mar. (In English)

Various experiments lead to the explanation of the discharge mechanism of P.I.G. as follows: (1) The discharge is mainly sustained by the ionization of gas molecules on the median plane between the cathodes of P.I.G. On this plane the electrons which ionize the gas molecules are set in motion similar to the electrons in the case of B-type oscillation of the split anode magnetron, the mechanism of which was interpreted by Tomonaga in 1948. (2) The reason why electrons move in this described manner, although the anode is not split, seems to be because of the inevitable defect in alignment of the electrodes. This results in distorted concentric equipotential lines. (auth)

23438

HIGH MAGNETIC FIELD RESEARCH. Harold P. Furth (Univ. of California, Livermore). Science 132, 387-93 (1960) Aug. 12.

A magnetic field is said to possess an energy density which is analogous to the thermal energy density of a gas. When a region of magnetic field is compressed or distorted, its energy content is raised. A magnetic field of 1 megagauss has an energy density of 40×10^3 ergs, or 1000 cal per cc, which is comparable to the chemical energy density of high explosives. The achievement of very high magnetic fields has obvious uses in pure and applied research. In high energy physics, the most common use is that of guiding energetic particles along paths that are more or less strongly curved, depending on the field strength and particle momentum. An analogy of the magnetic field is given as a "two-dimensional gas" in which the flux lines take the place of gas molecules. This analogy becomes exact for systems that are infinite and uniform along the direction of the field. The technological avenues being followed to produce high magnetic fields are reduction of input current requirement by means of a tubular coil wound of insulated wire, use of motional effects in solid tube design with a straight or helical slit, use of motional effects in solid but nonrigid tubes, use of conductive fluids, and reduction of magnetic forces by means of force-free geometric designs. (B.O.G.)

23439

FLUORESCENCE OF TRIVALENT DYSPROSIUM IN HEXAGONAL ZINC SULPHIDE AT 77°K. R. A. Ford and M. M. R. Williams (Mullard Research Labs., Salfords, Surrey, Eng.). Spectrochim. Acta 16, 721-9(1960) July.

The low-temperature fluorescence of Dy^{3+} in hexagonal ZnS was reported. Systems around 17,000 and 20,500 cm^{-1}, due to return from the resonance level to the $^6H_{13/2}$ and $^6H_{15/2}$ levels of the ground multiplet, were studied in detail. The assignment $^4I_{15/2}$ was made for the resonance level. The fluorescent lifetime of the $^4I_{15/2} \rightarrow {}^6H_{13/2}$ transition was found to be 8×10^{-5} sec, which is considerably shorter than the calculated radiative mean life. This result was discussed in terms of vibronic interaction with the crystal lattice. (auth)

23440

PRODUCTION OF NEGATIVE IONS IN NUCLEAR REACTIONS. Ya. M. Fogel. Uspekhi Fiz. Nauk 71, 243-87(1960) June. (In Russian)

The apparatus and methods used for measuring effective cross sections of negative ion production in nuclear collisions are described. Measurements of various effective cross sections are discussed. Problems which include the shape of the σ curve (v) as functions of the properties of the interacting particle pair, the interpretation of the $\sigma(v)$ curve shape based on the adiabatic Messi criteria with consideration of the participation of excited particle in the process; and the $\sigma(v)$ curve at small velocities $[(a/\Delta E/hv \gg 1)]$ and at $v > v_{max}$ are analyzed as well as the dependence of the cross section maximum on the various factors. Data are presented on slow negative ion production in nuclear collisions. (R.V.J.)

23441

SPECTRUM AND ZEEMAN EFFECT OF TRIVALENT PRASEODYMIUM IN HEXAGONAL ETHYL SULFATE. K. H. Hellwege, G. Hess, and H. G. Kahle (Technische Hochschule, Darmstadt, Ger.). Z. Physik 159, 333-47 (1960). (In German)

The visible absorption spectrum of Pr^{3+} in hexagonal (Ce,Pr) ethyl sulfate and its Zeeman effect in external magnetic fields were obtained at 4.2°K, and by assumption of a crystal field the symmetry D_{3h} was explained. The values of the crystal quantum number for the cleavage components of the terms, a crystal-field matrix element, and the Lande g factor of the term were determined. In the $^3H_4 \rightarrow {}^3P_0, {}^3P_1$ transition a clearly defined crystal hyperfine structure was observed. (tr-auth)

23442

ON THE TEMPERATURE DEPENDENCE OF MAGNETOSTRICTION. E. A. Turov and A. I. Mitsek (Inst. of Metal Physics, Academy of Sciences, USSR). Zhur. Ekspti'. i Teoret. Fiz. 38, 1847-51(1960) June. (In Russian)

The temperature dependence of linear (anisotropic) and volume (isotropic) magnetostriction was investigated in the low-temperature range on the basis of a phenomenological method of the spin-wave theory. (auth)

23443

VARIATIONAL PRINCIPLES FOR NONSTATIONARY QUANTUM MECHANICAL PROBLEMS AND PERTURBATION THEORY. Yu. N. Demkov (Leningrad State Univ.). Zhur. Ekspti'. i Teoret. Fiz. 38, 1879-86(1960) June. (In Russian)

A variational principle is formulated which is invariant with respect to normalization of wave functions and which can be used in the case of nonorthogonal wave functions of the initial and final states. The problem of uniqueness of perturbation theory in this case is considered. The possibility of employing the variational principle for solution of problems concerning decay of the quasi-stationary state and charge exchange is discussed. The main equations for charge exchange at large impact parameters are derived from the variational principle. (auth)

23444

NEGATIVE AND LIMITING TEMPERATURES. Yu. B. Rumer (Inst. of Radiophysics and Electronics, Siberina Section of the Academy of Sciences, USSR). Zhur. Ekspti'. i Teoret. Fiz. 38, 1899-1902(1960) June. (In Russian)

It is shown that the possibility of the existence of negative and limiting positive temperatures in a thermodynamical system is connected in the mathematical apparatus of statistical physics with the analyticity of the statistical sum as a function of the inverse temperature. (auth)

23445

DIRECT CONVERSION OF HEAT TO ELECTRICITY. Joseph Kaye and John A. Welsh, eds. New York, John Wiley & Sons, Inc., 1960. 369p. $8.75.

The papers presented at a Special Summer Program on the "Direct Conversion of Heat to Electricity" at the Massachusetts Institute of Technology on July 6 to 17, 1959, are contained. They represent the latest advances in this field of research. The papers were divided into five general areas as follows: 1. Thermionic Engines—High Vacuum. 2. Thermionic Engines—Low Pressure. 3. Magnetohydrodynamic Converters. 4. Semiconductor Devices. 5. Fuel Cells. Discussions of the practical applications and problems associated with each type of conversion scheme are given. (B.O.G.)

23446

GROUP THEORY IN QUANTUM MECHANICS. An Introduction to Its Present Usage. Volker Heine. International Series of Monographs on Pure and Applied Mathematics. Volume 9. New York, Pergamon Press, 1960. 477p. $15.00.

An introduction was given to the three main uses of group theory in quantum mechanics. These are to label energy levels and the corresponding eigenstates, to discuss qualitatively the splitting of energy levels as a start is made from an approximate Hamiltonian and correction terms are added, and to aid in the evaluation of matrix elements of all kinds and, in particular, to provide general selection rules for the non-zero ones. The theme is to show how all this is achieved by considering the symmetry properties of the Hamiltonian and the way in which these symmetries are reflected in the wave functions. The level of the text is that of a course for research students in physics and chemistry. A previous course in quantum theory is assumed, but the matrix algebra required is included as an appendix. (B.O.G.)

23447

PROGRESS IN CRYOGENICS. VOLUME 2. K. Mendelssohn, ed. New York, Academic Press Inc., 1960. 280p. $11.50.

A continuation is given of a series, international in character, which is intended to provide critical and up-to-date information in the various branches of cryogenics and to acquaint workers in one field of low-temperature research with techniques being developed in others. The articles cover the production, maintenance, and measurement of low-temperatures and their practical application to the techniques used in basic research. Eight articles are presented; separate abstracts were prepared for five. (B.O.G.)

23448

THE 1958 SCALE OF TEMPERATURES FOR THE LIQUID HELIUM-4 REGION. H. Van Dijk (Kamerlingh Onnes Lab., Leiden). p.121-45 of "Progress in Cryogenics. Volume 2." K. Mendelssohn, ed. New York, Academic Press Inc., 1960.

Temperatures in the 1958 scale are denoted by T_{58}. The tabulation shows the pressure of He^4 saturated vapor for each 0.01°K between 0.5° and 5.22°K. The basic information for the scale was obtained from measurements with the gas thermometer on isotherms, present knowledge of thermodynamic pT relation and of the quantities which appear in the relation, and measurements of vapor pressure as a function of the susceptibility of suitable paramagnetic salts. (B.O.G.)

23449
UNSTEADY MOTION OF CONTINUOUS MEDIA. K. P. Stanyukovich. Translation by J. George Adashko. Translation edited by Maurice Holt. New York, Pergamon Press, 1960. 754p. $15.00.

Problems in the theory of unsteady motion of any medium, with particular attention to the unsteady motion of gases, are treated. Certain aspects of stationary or steady motion are discussed. Isentropic motion, occurring at constant entropy over the range under consideration, as well as non-isentropic motion in which shock waves are important, are considered. The mathematical and thermodynamic tools of gas dynamics are discussed with consideration for the investigation of the so-called self-similar motions. In the study of the motion of gas in a gravitational field as related to problems in astrophysics and cosmology, new methods are used for the approximate integration of the equations of non-isentropic gas motion. For a more thorough understanding of the material, the reader should be acquainted with the theory of differential equations of mathematical physics, vector and tensor analysis, and with the elements of thermodynamics. (B.O.G.)

23450
NUCLEAR RADIATION ENGINEERING. AN INTRODUCTION. F. W. Hutchinson. New York, The Ronald Press Company, 1960. 160p.

The fundamentals of atomic structure, the source of nuclear energy, and the principles of radioactivity are presented on a basic level for the purpose of improving the understanding between the executive nonspecialist and the atomic scientist or nuclear engineer. It involves a knowledge of the atomic and nuclear causes of radioactivity, the kinds of radioactivity, the energy release associated with the process of radioactive disintegration, and the effects of radiation. The material is based on a series of lectures that were given for executives, supervisors, and engineers at the Boeing Airplane Company at Seattle. A dictionary of atomic and nuclear terms and phrases is included. (B.O.G.)

Astrophysics and Cosmology

23451 JPRS-5059
SOLAR ACTIVITY AND ITS EFFECT ON THE IONOSPHERE. N. Ya. Bugoslavskaya. Translated from p.1-31 of "Solnechnaya Aktivnosti i yeye Vliyaniye na Ionosfere." 53p. OTS.

A review of basic data on the composition of solar radiation and the connection between the ionospheric and magnetic disturbances which influence the degree of radio communication stability is given. The radiation from various active regions of the sun is also considered. Conditions of atmospheric illumination as a function of earth latitude are examined, and processes in individual active regions of the sun are considered along with ionospheric magnetic disturbances. (J.R.D.)

23452
THE RECORD IN THE METEORITES. III. ON THE DEVELOPMENT OF METEORITES IN ASTEROIDAL BODIES. Robert A. Fish, Gordon G. Goles, and Edward Anders (Univ. of Chicago). Astrophys. J. 132, 243-58(1960) July.

It was proposed that the meteorites originated in planetesimals of asteroidal dimensions, heated by some transient internal energy source, such as extinct radioactivity. The usual objections to an origin in small bodies were examined and were shown to be unfounded. It was shown that segregation of metal and silicate phases and mineral differentiation by crystal settling will take place on reasonable time scales even in small bodies. Evidence concerning the occurrence of diamonds in meteorites was critically examined and was found to be inconsistent with an origin in large bodies. Instead, it was decided that diamonds were formed as a metastable phase by decomposition of cohenite (Fe_3C) under localized stresses or else upon impact with the earth (as proposed by Nininger). A detailed study of the thermal evolution of internally heated planetesimals was undertaken with a view to discovering spontaneous processes that might have led to the development of the meteorites. After the onset of melting, the equilibrium configuration of the planetesimal will comprise an inner core of metal and an outer core of silicate; a mantle of chondritic composition, compacted by sintering; and an unconsolidated surface layer. The expected properties of material from each of these strata agree well with those of the known classes of meteorites. Further temperature rise in the planetesimal will result in quasi-volcanic eruptions due to evolution of gases and vapors (e.g., elemental sulfur, carbon monoxide, silicon monosulfide) from the interior. This quasi-volcanic activity will cause extensive recycling of material and can lead to the development of many detailed features of the meteorites. Evidence was presented to show that the capillary veins in stone meteorites were produced by momentary action of hot, sulfur-containing gases. This was in accord with the proposed model. Another consequence of the model is the operation of a cyclic process that will deplete the chondritic mantle in some chalcophile elements, such as In, Tl, Pb, and Bi. This may account for the discrepancies between the observed and predicted abundances of these elements in chondrites. Possible energy sources were critically examined. Only extinct radioactivity seems to meet all requirements. In order for this source to have been important, it is necessary for the parent bodies of the meteorites to have accreted within 6 to 7 million years after nucleogenesis, in which case 7.3×10^5-year Al^{26} could have provided an adequate source of heat, or that an uncharacterized nuclide with a half life of 10^6 to 10^8 years exists and was present in the early solar system. (auth)

23453
OSCILLATIONS OF AN INCOMPRESSIBLE FLUID SPHERE OF VARYING DENSITY. S. K. Trehan (Princeton Univ., N. J.). Astrophys. J. 132, 264-8(1960) July.

The oscillations of a self-gravitating imcompressible fluid sphere of varying density were investigated. It was found that for the same total mass a sphere of uniform density has a longer period of oscillation than a sphere of varying density. (auth)

23454
ABUNDANCE OF LITHIUM AND ORIGIN OF THE SOLAR SYSTEM. T. Gold (Cornell Univ., Ithaca, N. Y.). Astrophys. J. 132, 274-5(1960) July.

Comments are given concerning a paper by Bonsack and Greenstein (1960) on the abundance of lithium in T Tauri stars and on the origin of the solar system. The lithium evidence strongly suggests that planetary materials once were part of the sun as an outer envelope that was later thrown off; and then, perhaps through magnetic interaction, regained almost all the angular momentum initially present in the sun. The inference was drawn that T Tauri stars must be capable of manufacturing lithium, and it was estimated that there was at least ten times more lithium per gram of material on the surfaces of the stars than in the surrounding nebular material. (B.O.G.)

23455

ADIABATIC INVARIANTS IN QUANTUM MECHANICS.
L. M. Garrido (Facultad de Ciencias, Saragossa, Spain).
Physica 26, 501-4(1960) July. (In English)

It is shown that the constants of motion of a system evolving under a time-independent Hamiltonian H_0 are adiabatic invariants to the nth order, in certain cases, and to all order in other cases, of the system evolving under a slow time dependent Hamiltonian $H = H_0 + H_1(t)$. (auth)

23456

DISSIPATION FUNCTIONS AND INVARIANT IMBEDDING. [PART] I. Richard Bellman, Robert Kalaba, and G. Milton Wing (RAND Corp., Santa Monica, Calif.). Proc. Natl. Acad. Sci. U. S. 46, 1145-7(1960) Aug.

A new method for establishing the existence of solutions to nonlinear functional equations for the description of radiative transfer, neutron transport, diffusion and heat conduction, scattering and random walk, and wave propagation is presented. This method is based on the introduction of a new class of physically important functions, the dissipation functions. It is essential for the rigorous formulation of the invariant imbedding approach to present these existence theorems. The results give a new approach, independent of characteristic values and spectral theory, to the classical linear transport processes. (M.C.G.)

Cosmic Radiation

23457 AD-236493

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
EARTH'S GEOMAGNETICALLY TRAPPED CORPUSCULAR RADIATION (thesis). Donald Gilbert Carpenter. Mar. 1960. 103p.

The data concerning the entrapped corpuscular radiation surrounding Earth are summarized. Theories providing possible explanations for the existence of this radiation, as well as the connections between it and such phenomena as aurora and magnetic storms, are discussed. The data-collecting methods, such as rockoons, balloons, nuclear detonations, rockets, and satellites, are referred to by experiment. Rocket and satellite experiments needed to collect further data are discussed. The special Van Allen belt environmental problems of corpuscular and electromagnetic radiation, temperature, and electrostatic and magnetic effects are considered. Space-vehicle-borne nuclear reactor contribution is discussed. A comprehensive bibliography is included. (auth)

23458 NP-9209

Minnesota. Univ., Minneapolis. School of Physics.
TABULATION OF HIGH ALTITUDE RADIATION DATA FOR THE IGY PERIOD. John R. Winckler. Apr. 1960. 199p. (CR-28).

Numerical data obtained from high-altitude balloon flights during the IGY period are presented. Normalized ionization chamber rates and normalized Geiger counter rates are reported for all flights. Geographic latitudes and longitudes obtained from radio direction equipment and from aerial camera photographs are included. Data obtained during ascent of the balloon are given in graphical form and include the ratio (ion rate/counter rate) as a function of balloon pressure height. (C.J.G.)

23459

HIGH ENERGY NUCLEAR INTERACTIONS OF HEAVY COSMIC RAY PRIMARIES. E. Balea, E. Friedländer, M. Oncescu, C. Potoceanu, and M. Sahini. Acad. rép. populaire Roumaine, Rev. phys. 5, 91-8(1960). (In English)

The results obtained in the investigation of interactions of primary nuclei with charge $Z \geq 2$ with emulsion nuclei were described. The primary purpose was to detect in some of the heavy primary induced jets the coexistence of the evaporation jet of the incident nuclei and of the meson jet produced in the collision. The physical foundation of the two-center model was examined. The results show that heavy primary induced jets frequently have a two-cone structure which can be interpreted in a satisfactory manner by means of the two-center model. The existence of two such centers in heavy primary induced jets makes unlikely the interpretation of these centers as excited nucleons. If the interaction of two nuclei is strong enough to produce mesons, it is improbable that the fragmentation of the incident nucleons is restricted only to the evaporation process. Most of its nucleons suffer either inelastic collisions leading to meson production or meson scattering on the target nucleons. (J.S.R.)

23460

A WORLD-WIDE STUDY OF THE DAILY VARIATION OF THE NUCLEONIC COMPONENT OF COSMIC RAYS.
J. Katzman and D. Venkatesan (National Research Council, Ottawa). Can. J. Phys. 38, 101-26(1960) Aug.

The semidiurnal component of the nucleonic intensity at Ottawa, Canada, is essentially a pressure effect for the 5-year period, 1955 to 1959. The diurnal variation is composed of the component due to pressure, and a component that may be attributed to an anisotropy of the primary cosmic-ray particles. The results are confirmed by a comparative study of the data from 15 stations between the geomagnetic latitudes 83° N and 73° S. A world-wide barometric coefficient of −0.72% per mb was obtained from the semidiurnal component and this coefficient was used to correct the diurnal component at all the stations. The average corrected diurnal variation during the period of study common to all stations, August 1957 to October 1958, is 0.27% and occurs at 14 hr 16 min solar time. There is considerable spread in both amplitude and phase angle among the various stations. The root mean square differences from the mean amplitude is ±0.05% and from the mean phase angle is ±10° (40 minutes in time). The difficulty of drawing definite conclusions about the anisotropy from short-term studies of individual stations is pointed out. (auth)

23461

DETERMINATION OF ELECTRON CONCENTRATION IN THE IONOSPHERE FROM THE ROTATION OF THE PLANE OF POLARIZATION OF RADIOWAVES EMITTED BY A ROCKET. K. I. Gringau and V. A. Rudakov. Doklady Akad. Nauk S.S.S.R. 132, 1311-13(1960) July 21. (In Russian)

One of the methods of measuring electron concentrations, used by the Academy of Sciences in rockets at 450 km and over, and the data obtained Aug. 27, 1958, are described. The method is based on the Faraday effects; the measurements are carried out on earth by observations of the polarization rotation of radiowaves emitted from vertically launched rockets stabilized in relation to three possible rotation axis. Correlations of the electron-concentration data obtained Feb. 21, 1958, with those of Aug. 27, 1958, show that in the second instance the electron density reduction with elevation over the maximum of F layer is much slower than in the first. (R.V.J.)

23462

DIURNAL VARIATION IN COSMIC-RAY INTENSITY, 1937-1959, AT CHELTENHAM (FREDERICKSBURG), HUANCAYO, AND CHRISTCHURCH. Scott E. Forbush and D. Venkatesan (Carnegie Institution, Washington, D. C.). J. Geophys. Research 65, 2213-26(1960) Aug.

The 24- and 12-hr waves in cosmic-ray intensity at Cheltenham (Fredericksburg), Huancayo, and Christchurch and their variability are analyzed statistically, using data, corrected for pressure, for the period 1937 to 1959 from Compton-Bennett ionization chambers. The degree of correlation between the deviations of yearly mean 24-hr waves (from their 23-year means) at any two of the stations is almost as great as can be expected when account is taken of the noise level inherent in the instruments. The deviations of yearly means from their 23-year averages indicate large secular variations which may be due to a quasi-systematic 22-year variation. The phase difference between these yearly deviation vectors at Huancayo and Cheltenham (or Christchurch) is considerably less than that between the average vectors for 23 years. The statistical reality of the 12-hr wave is definitely established at all three stations although, at least at Huancayo, the average 12-hr wave probably results entirely from systematic errors due to exceedingly small frictional effects in the barograph. (auth)

23463

BACKSCATTER OF COSMIC RAYS BY THE SUN'S H II SPHERE. G. A. Newkirk, J. W. Warwick, and H. Zirin (Univ. of Colorado, Boulder). J. Geophys. Research 65, 2540-2(1960) Aug.

A study was made of the backscatter of cosmic rays by the sun's H II sphere. The concept of a huge solar wind that was advanced in this study to explain the magnetic barrier postulated outside the earth's orbit was shown to be contradictory to the observed structure of the corona. The model of a huge field-free hollow around the sun, however, was explained by the static pressure of hot interplanetary gas. The sphere of ionized hydrogen around the sun reaches a point at which the gas changes to neutral hydrogen. A reasonable model requires an external magnetic field to balance the hydrostatic pressure of the inner field. (M.C.G.)

23464

ON THE HIGH ENERGY SOFT COMPONENTS AT 2770 m ALTITUDE. Tadashi Kameda and Toshio Maeda (Kobe Univ., Japan). J. Phys. Soc. Japan 15, 1367-72(1960) Aug. (In English)

An apparatus consisting of GM-counter hodoscopes and an ionization chamber with large area was used to measure cascade showers initiated by electrons and photons at 2770 m altitude (Mt. Norikura). The number of shower particles deduced from the pulse height of the ionization chamber was converted into energy of the electron (or photon) initiating the shower. The results show that, in the energy range of 2 to 20 Bev, the zenith angle distribution of electrons is represented by $\cos^6 \theta$, the differential energy spectra can be represented by a power law of the form $E^{-\gamma}$ with γ of 2.90 ± 0.05 and 2.83 ± 0.05 for electrons and photons, respectively, and the upper limit of the ratio of the number of electrons to that of photons is 1.1 ± 0.01. The results were compared with those obtained near sea level and the origin of the soft component was also discussed. (auth)

23465

SOME FEATURES OF EXTENSIVE AIR SHOWERS OF PRIMARY ENERGY $\geq 10^{14}$ eV. B. N. Srivastava and A. N. Suri (D.S.B. Government Coll., Naini Tal, India). J. Sci. Ind. Research (India) 19B, 221-2(1960) June. (In English)

Data for 10,000 air showers with energies $\geq 10^{14}$ ev recorded over a period of four months were analyzed for solar diurnal and semi-diurnal variation. The bi-hourly rates were analyzed and their amplitudes calculated. Separation of individual events in time was recorded along with their frequency of occurrence during the entire period of observation. (M.C.G.)

23466

THE DIRAC MONOPOLE AS A CONSTITUENT OF PRIMARY COSMIC RADIATION. N. A. Porter (University Coll., Dublin). Nuovo cimento (10) 16, 958-9(1960) June 1. (In English)

The Dirac monopoles were employed in order to explain those effects in large extensive air showers which are well established experimentally but not satisfactorily explained. These effects include solar time variations, primary number spectrum, sidereal variations, and shower structure. It is suggested that most of these effects could be understood if it is assumed that a very small fraction, about 10^{-14}, of all primary cosmic particles are Dirac monopoles. (B.O.G.)

23467

ON THE N-COMPONENT IN EXTENSIVE AIR SHOWERS. D. S. Narayan and G. B. Yodh (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 16, 1020-39(1960) June 16. (In English)

According to Nikolskij et al. (1957), the number of nuclear-active (N) particles in air showers increases fairly slowly as $E^{0.2}$ for showers ranging in energy from 10^{13} to 10^{15} ev. At energies $>10^{15}$ ev the increase is more rapid and is $\propto E$. This variation in the N-component with the size of the shower and certain other observed features of air showers have been interpreted previously as an indication of a change in the nature of nuclear interactions at very high energies or as an indication of specific details in the nature and composition of the primary cosmic radiation, such as the existence of a cut-off in the magnetic rigidity of the particles and the predominance of heavy primaries at very high energies. An attempt is made to explain the above observed features in terms of certain characteristics of nucleon-nucleus (n-N) and pion-nucleus (π-N) collisions; the term "nucleus" here refers to an "air nucleus". The main aspect of the Nikolskij curve for the abundance of N-particles vs. shower energy is not the rapid increase of the N-component in showers of energy $>10^{15}$ ev, nor the existence of a change in the abundance of N-particles in going from small showers to big showers, but rather the fairly slow increase in the number of N-particles in showers of energy (10^{13} to 10^{15}) ev. This slow increase, which is contrary to general experience in cascade calculations, puts stringent limitations on the choice of parameters that characterize n-N and π-N collisions. It is shown that n-N and π-N collisions are largely elastic and that the number of secondary nucleons produced in such collisions is quite small (of the order of one or two); further, in a π-N collision, the energy going into the nucleon component is a very small fraction of the energy of the incident pion. These features also result in a rapid increase in the N-component of big showers; this arises as a result of the complicated role played by charged pions owing to their finite life time. In small showers the charged pions have only small energies and hence they mostly decay and do not contribute appreciably to the N-component. In big showers, however, the pions have sufficiently high energy to make nuclear interactions before decaying and owing to the large multiplicity of pions produced in n-N and π-N collisions, there is a rapid increase in the number of N-particles with increasing energy of the shower. Some experiments are suggested to distinguish between the various possible explanations. (auth)

23468

ON THE RELATIVE ABUNDANCE OF CARBON, NITROGEN AND OXYGEN IN THE COSMIC RAYS. C. Q. Orsini (Università, Turin). Nuovo cimento (10) 16, 1040-5(1960) June 16. (In English)

Plates (33 G-5 emulsions) were exposed at an atmospheric depth of approximately $6\ g/m^2$. Gap length measurements of 220 medium nuclei have these ratios C : N : O : : 1.5 : 0.97 : 1.0. By using different parameters in the diffusion equation agreement could be obtained with the values of Suess and Urey's cosmic abundances. The results indicate that the chemical composition of the sources of cosmic rays is different from the mean composition of the Universe. (auth)

23469

PION CLOUD EFFECTS AND THE TWO-CENTER MODEL OF COSMIC-RAY JETS. E. M. Friedländer (Inst. of Atomic Physics, Bucharest). Phys. Rev. Letters 5, 212-13 (1960) Sept. 1.

The two-cone structure of cosmic-ray jets is studied from the viewpoint of peripheral collisions involving 1 or 2 pions in the meson cloud of the colliding nucleons in interactions at energies >1 Bev. It is concluded that at high energies $\gamma_1/\gamma_2 \cong 6.67$ and $\overline{\gamma} \cong 1.49$ and at low energies both approach unity. Seventy-eight jets (p, n, and α events) were analyzed and the experimental γ_1/γ_2 and $\overline{\gamma}$ values compared with the computed ones. (D.L.C.)

23470

COSMIC RAYS AT SEA LEVEL AND THE EARTH'S MAGNETIC FIELD. Masahiro Kodama. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 54, 20-42(1960) Mar. (In English)

Measurements of cosmic-ray nucleon and meson components were carried out along a sea level course between Japan and the Antarctic during 1956—57 and during 1958—59. The following results were obtained from these latitude surveys: (1) the position of cosmic-ray equator at 107°E geographic longitude is situated at 5°S geomagnetic latitude which coincides with the geomagnetic dip equator measured simultaneously and (2) the position of latitude knee at about 20°E geographic longitude in the south hemisphere is much lower than the ordinary one and corresponds to 6.4 Bev for cut-off rigidity calculated for the eccentric dipole model of the earth's magnetic field. Comparison of results of the two surveys showed that the rigidity spectrum changed in the region 6 to 8 Bev of the cut-off rigidity. By using these results together with the available results of latitude surveys obtained by many researchers, world-wide distribution of cosmic-ray neutron intensity at sea level was determined. From comparison of the world map thus obtained with various models for the earth's magnetic field, it was concluded that the geomagnetic effect of the earth's magnetic field upon cosmic rays is mostly subjected to the geomagnetic field including higher order terms in the earth's potential. (auth)

23471

THE PROBLEM OF HIGH-ENERGY PARTICLES. ELEMENTARY NUCLEON—NUCLEON INTERACTIONS IN COSMIC RADIATION. N. A. Dobrotin. Vestnik Akad. Nauk S.S.S.R. 30, No. 7, 21-5(1960) July. (In Russian)

Data on cosmic nucleon—nucleon interactions are reviewed. The data indicate the following three types of showers: in the first type the peripheral collisions have small coefficients of inelasticity, are close to each other, and the angular distribution of secondary mesons in the gravity center is symmetric; in the second type one coefficient of inelasticity is larger than the other and the secondary mesons are strongly asymmetric; and in the third type both coefficients of inelasticity are larger (0.5) and the shower is more or less symmetric. (R.V.J.)

Criticality Studies

23472 AD-236491

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

CONCEPTUAL DESIGN OF A CRITICAL FACILITY FOR THE AIR FORCE NUCLEAR ENGINEERING TEST FACILITY (thesis). Lawrence Duane Johnson and Richard Joseph Vossler. Mar. 1960. 119p.

Justification for the construction of a critical mock-up of the Nuclear Engineering Test Reactor and its immediate appurtenances at Wright-Patterson Air Force Base, Dayton, Ohio, is presented. Uses of this reactor may include reactivity effects measurements, reactor physics studies, analysis of NETR core modifications, fuel appraisal, and utilization by other agencies of the Wright Air Development Division. The functional requirements, design philosophy and criteria, design specifications, and the conceptual design of the critical facility are included. More detailed design considerations of the core, test facilities, and instrumentation and control systems are covered. A preliminary hazard summary report is also included. (auth)

23473 IDO-16280

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CRITICALITY CALCULATIONS WITH REGARD TO THE DISSOLUTION OF 2% ENRICHED SLUGS. J. W. Webster. June 22, 1955. Decl. Apr. 28, 1960. 10p. Contract AT(10-1)-205. (PPC-201). OTS.

The minimum critical mass for 0.5 in., 2% enriched, nonalloyed slugs in water is calculated to be about 265 kg. Since the slugs will be randomly distributed in the dissolver, the critical mass would be much more than this minimum calculated critical mass. It is concluded that it is safe to put 250 kg in the dissolver. (auth)

23474

ON THE DETERMINATION OF THE CRITICALITY CONDITIONS BY THE MULTIPLE COLLISION METHOD. Takumi Asaoka (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 401-5(1960) July. (In Japanese)

The criticality conditions of the multiplying medium are derived analytically by the multiple collision method based on the viewpoint of the Monte Carlo approach. The successive life cycles of a typical neutron, in which the collision with a nucleus in the medium is regarded as an end of each life cycle, are followed statistically in order of time. The total number of neutrons in the medium is obtained by summing up those in every life-cycle and the criticality condition is derived from the convergence condition as time proceeds to infinity. The criticality of the one-dimensional homogeneous medium with isotropic scattering in the one-velocity theory is treated. The well-known criticality condition is obtained easily for the infinite medium. For the finite medium, the critical equation is reduced to an infinite set of simultaneous equations which are valid when the thickness of the slab is much smaller than the mean free path. The approximate solution is obtained and discussed (auth)

Elementary Particles and Radiations

23475 AFOSR-TN-60-530
Johns Hopkins Univ., Baltimore.
THE MASS OF THE SIGMA-PLUS HYPERON. H. F. Perry and A. Pevsner. June 1960. 17p. Contract AF18(603)-143.

The stars produced by mesons (K^-) stopping in nuclear emulsion were investigated to find examples of the decay at rest of $\Sigma^+ \rightarrow p + \pi^0$. Fourteen examples of this decay were obtained. The mean weighted range of the proton, corrected to the range in emulsion of standard density, is 1676.3 ± 7.7 microns. This corresponds to a kinetic energy of 18.85 Mev. The mass of the Σ^+ was found to be 1189.41 ± 0.54 Mev. (auth)

23476 IFA-EM-39
Academia R. P. R. Institutul de Fizică Atomică, Bucharest.
CENTRAL AND PERIPHERIC INTERACTIONS OF 7.3 GeV NEGATIVE PIONS IN EMULSIONS. E. M. Friedländer, M. Marcu, and M. Spîrchez. Apr. 30, 1960. 12p.

The results of an emulsion experiment with high-energy negative pions are reported. A stack of 100 NIKFI-R pellicles was irradiated in the 7.3 Bev π-beam of the JINR proton synchrotron to a total exposure of 1.3 × 10 pions/cm^2. 543 interactions were detected by area scanning. (W.D.M.)

23477 NBS-5944
National Bureau of Standards, Washington, D. C.
SLANT PENETRATION OF γ-RAYS IN H_2O. L. V. Spencer and James Lamkin. July 17, 1958. 42p. NBS Projects 0400-40-3001 and 0408-12-3110.

Tabulations are presented of the gamma dose at various distances from monoenergetic plane slant sources in an infinite water medium. The source energies range from 10.22 to 0.34 Mev in an approximately logarithmic sequence. Source obliquities from emission perpendicular to the source plane to emission parallel to the source plane are treated. The calculations were accomplished with the moment method, using an IBM 704. (auth)

23478 NBS-6591
National Bureau of Standards, Washington, D. C.
SLANT PENETRATION OF γ-RAYS IN CONCRETE. L. V. Spencer and J. C. Lamkin. Nov. 10, 1959. 65p. NBS Project 0400-40-04400.

Tabulations are presented of the gamma dose at various distances from monoenergetic plane slant sources in an infinite concrete medium. The source energies range from 10.22 to 0.043 Mev in an approximately logarithmic sequence. Source obliquities from emission perpendicular to the source plane to emission parallel to the source plane are treated. The calculations were accomplished with the moment method using an IBM 704. (auth)

23479 NP-8955
Florida. Univ., Gainesville.
GAMMA RAY SCATTERING. Quarterly Technical Progress Report No. 2 for the Period March 18, 1959 through June 18, 1959. John A. Wethington, Jr., H. L. Sahlin, K. R. Rao, and R. A. Karam. 4p. Contract NOas 59-6013-c.

Work was centered on learning to use the gamma-ray spectrometer. (For preceding period see NP-8954.) (W.L.H.)

23480 NP-8956
Florida. Univ., Gainesville.
GAMMA RAY SCATTERING. Quarterly Technical Progress Report No. 3 for the Period June 18, 1959, Through September 18, 1959. John A. Wethington, Jr., H. L. Sahlin, K. R. Rao, and R. A. Karam. 35p. Contract NOas 59-6013-c.

The work on γ-ray scattering included experiments with powders, layers of single metal foils, layers of mixed metal foils, lead–plastic combinations, and electrical experiments. (For preceding period see NP-8955.) (W.L.H.)

23481 NP-8957
Florida. Univ., Gainesville.
GAMMA RAY SCATTERING. Quarterly Technical Progress Report No. 4 for the Period September 18, 1959 through December 18, 1959. John A. Wethington, Jr. and R. A. Karam. 23p. Contract NOas 59-6013-c.

Work was continued on the polyethylene-lead combinations. The details of the experiments and the results are reported. (For preceding period see NP-8956.) (W.L.H.)

23482 NP-8958
Florida. Univ., Gainesville.
GAMMA RAY SCATTERING. Quarterly Technical Progress Report No. 5 for December 18, 1959 through March 18, 1960. John A. Wethington, Jr. and R. A. Karam. 13p. Contract NOAS 59-6013-c.

Some additional experimental data are reported on polyethylene–lead combinations. These data were converted into dose rates and dose build-up factors. The experimentally determined dose build-up factor for a combination of polyethylene followed by lead was compared with a calculated-dose build-up factor. (For preceding period see NP-8957.) (auth)

23483 NYO-9085
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
THE SPECTRUM OF A NEUTRON TRANSPORT OPERATOR. Roger N. van Norton. June 1, 1960. 37p. Contract AT(30-1)-1480. OTS.

The spectrum of the monoenergetic neutron transport operator for a homogeneous sphere where the neutrons are scattered with spherical symmetry in the lab system is considered. The characteristic valve problem is analyzed. (W.D.M.)

23484 SPM-525
[France. Commissariat a l'Energie Atomique, Paris].
THERMALISATION DES NEUTRONS. (Thermalization of Neutrons). B. Bailly du Bois, J. Horowitz, and C. Maurette. Dec. 11, 1958. 54p.

A calculation is presented of the thermalization of neutrons in an infinite homogeneous medium with uniform sources. The two extreme cases of hydrogen and a heavy moderator in the gaseous model are studied using the $G(v' \rightarrow v)$ functions calculated by Wigner and Wilkins. (T.R.H.)

23485 TID-6208
Yale Univ., New Haven.
NUCLEAR FORCES AND POLARIZATION PHENOMENA. G. Breit. [July 1960]. 27p. Contract [AT(30-1)-1807]. OTS.

The most hopeful approach to a potential describing the interaction between two nucleons is that of employing phase shifts supplemented by coupling parameters between states with the same total angular momentum but different orbital angular momenta. At high energies the number of phase-parameters to be considered is so large that their determination from the scattering cross section alone becomes impossible. The polarization of the scattered particles is of help in restricting the possibilities to a smaller number and in indicating qualitatively the presence or absence of phase shifts. (W.D.M.)

23486 UCRL-9080(Rev.)
California. Univ., Berkeley. Lawrence Radiation Lab.
EFFECT OF THE $\pi-\pi$ RESONANCE IN THE REACTION $\pi + N \rightarrow 2\pi + N$. Yongduk Kim. Feb. 5, 1960. 15p. Contract W-7405-eng-48. OTS.

Experiments are being contemplated to measure π-π cross sections in the processes; $\pi^+ + p \rightarrow 2\pi^+ + n$, $\pi^- + p \rightarrow \pi^+ + \pi^- + n$, $\pi^- + p \rightarrow \pi^- + \pi^0 + p$, and $\pi^+ + p \rightarrow \pi^+ + \pi^0 + p$. The cross sections are estimated by use of the theoretical resonance prediction for $\sigma_{\pi\pi}$ in the $I = 1$ state. The same processes are considered in terms of the statistical model. By comparing the two results, suitable regions are found in the phase space for the experiments to be performed. (W.D.M.)

23487 WADC-TR-59-510
National Bureau of Standards, Washington, D. C.
STANDARDIZATION OF THERMAL EMITTANCE MEASUREMENTS. Period Covered: July 1, 1958 through June 30, 1959. William N. Harrison, Joseph C. Richmond, Earle K. Plyler, Ralph Stair, and Harold K. Skramstad. Aug. 10, 1959. 33p. Project No. 7360. Contract AF33 (616)-58-20. OTS.

The principles governing emission, transmission, reflection, and absorption of radiant energy are briefly reviewed. A double-beam ratio-recording spectrometer was modified for use in comparing radiant energy beams emitted by a blackbody furnace and a specimen at the same temperature, and in recording automatically a curve of normal spectral emittance of the specimen as a function of wavelength. Preliminary designs of equipment were formulated for the automatic recording of spectral emittance data in a form suitable for direct entry into a computer, and for the on-line, automatic processing of data to obtain a single value for total emittance or for absorptance for radiant energy of any known spectral distribution. (auth)

23488
ON THE AZIMUTHAL DISTRIBUTION OF MESON JETS. E. Balea, E. Friedlander, and C. Potoceanu. Acad. rép. populaire Roumaine, Rev. phys. 4, 441-4(1959). (In English)

It is well known that if the two-center model of nucleon-nucleon interactions at high energy is valid, deviations from uniformity of the azimuthal distribution of secondaries are to be expected. An attempt to detect such an effect by the comparison of the azimuthal distribution of jets produced by protons and by heavy primary nuclei is described. The azimuthal distribution of the proton-generated jets showed considerable deviations from uniformity. The azimuthal distribution of α and Hp jets, however, is compatible with a uniform distribution. The results lead to the conclusion that at least a fraction of the p jets deviates significantly from uniformity of the azimuthal distribution. (J.S.R.)

23489
DIFFUSE X-RAY SMALL ANGLE SCATTERING. DETERMINATION OF SIZE AND SHAPE OF COLLOIDAL PARTICLES AND MACROMOLECULES. O. Kratky (Universität, Graz). Angew. Chem. 72, 467-82(1960) July 21. (In German)

X-rays are scattered in the small angle range on particles of colloidal dimensions. From the dependence of angle and the absolute value of the scattering intensity, conclusions can be drawn as to particle size and shape. Such measurements render valuable service, e.g., for the investigation of proteins, fibres, plastics, alloys, and catalysts. A review is given on principles of theory and apparatus and on experimental possibilities of the method. (auth)

23490
THE COHERENT SCATTERING OF X-RAYS IN THE DIRECTION OF THE PRIMARY BEAM. L. P. Hyvärinen (Inst. of Tech., Helsinki). Ann. Acad. Sci. Fennicae. Ser. A VI, No. 45, 1-9(1960). (In English)

The problem of forward scattering of X rays by a homogeneous and amorphous slab of matter was treated using two slightly different approaches. The first one utilized the classical Thomson scattering amplitude for a free electron and Fresnel diffraction, this failed to give acceptable results. The zero-order diffraction peak became too strong leading to an impossible result. In this treatment the multiple scattering was to be allowed for by introducing a factor due to interference in the matter which modified the phase velocity. This, however, affected equally the direct as well as the scattered rays. Thus no net phase shifts were produced. In the second approach the multiple-scattering appeared as overlapping of cross section areas in the two-dimensional projection along constant phase surfaces. The stamp analogy served to make the treatment more illustrative. The final result indicates that multiple scattering always destroys the coherent scattering intensity in the forward direction or that it cannot be separated from the primary beam because the final intensity depends exponentially on the thickness z. The result was based on a random distribution of electrons and did not hold for ideal crystals with anomalous absorption properties explained by the dynamical theory, but in a polycrystalline sample, where the grains were much smaller than the Fresnel zones, the randomness was well satisfied and no anomaly was observed. (auth)

23491
INTERPRETATION OF γ-RAY SCINTILLATION SPECTRA FROM FISSION-PRODUCT MIXTURES. D. H. Peirson (Atomic Energy Research Establishment, Harwell, Eng.). Brit. J. Appl. Phys. 11, 346-53(1960) Aug.

Gamma scintillation spectra are calculated for the products of simultaneous slow neutron fission of U^{235}. These theoretical spectra serve as a basis for comparison with practical measurement of fission product mixtures. The variation with time, from 1 to 28 days, of the photoelectric peak height is shown for the prominent fission product activities. A rapid method of half-life analysis is described for use when peaks are inadequately resolved in energy. The effect of spectrometer resolution is discussed. (auth)

23492
A POSSIBLE MECHANISM OF THE HIGH ENERGY MAXIMA IN PION-NUCLEON CROSS SECTIONS. W. Królikowski (Univ. of Warsaw). Bull. acad. polon. sci., Sér. sci., math., astron. et phys. 8, 229-31(1960). (In English)

The motion of the core inside the nucleon was studied as a possible reason for three high energy maxima observed in π^--p and π^+-p scatterings. These peaks could be resonances provided by a coupling of slowly moving core inside the nucleon to the pion field. It appeared probable that the observed high peaks were due to $D_{3/2,1/2}$, $D_{3/2,3/2}$, and $D_{5/2,3/2}$ resonant states. (M.C.G.)

23493

FOURTH ORDER SCATTERING MATRIX ELEMENTS OF NUCLEONS WITH A FOURTH ORDER MESON EQUATION. S. P. Misra (Ravenshaw Coll., Cuttack, India). Indian J. Phys. 34, 221-36(1960) May. (In English)

The important fourth-order matrix elements with a fourth-order meson equation were calculated. It was noted that the charge renormalization obtained with this theory was finite and small for a reasonable value of the coupling constant. The contribution from the meson self-energy diagram remained unaltered and thus contained an infinity. A consistent interpretation of this term as meson-mass renormalization was obtained only if the bare meson had two different rest-masses. (auth)

23494

LIQUID SCINTILLATION COUNTING OF α-PARTICLES AND ENERGY RESOLUTION OF THE LIQUID SCINTILLATOR α- AND β-PARTICLES. H. H. Seliger (Johns Hopkins Univ., Baltimore). Intern. J. Appl. Radiation and Isotopes 8, 29-34(1960) May. (In English)

Experimental conditions were determined for the absolute counting of α particles in the liquid scintillator. Results were compared with those obtained by 4π gas proportional counting. From an analysis of the pulse height distributions obtained for polonium α particles and Ba^{137} conversion electrons, it was possible to calculate a conversion efficiency in the liquid scintillator of approximately 1 photon per 125 ev for β particles and 1 photon per 1400 ev for α particles. A further analysis of the phototube noise spectrum showed that the observed phototube noise pulses were primarily due to photocathode emission of single electrons. (auth)

23495

MEASURING THE RATIO OF EPI-THERMAL TO THERMAL NEUTRON DENSITIES USING THICK GOLD FOILS. Akira Furuhashi (Japan Atomic Energy Research Inst., Tokyo), Keishi Matsumoto, and Makoto Obu. J. Atomic Energy Soc. Japan 2, 394-400(1960) July. (In Japanese)

Measurements were made of the cadmium ratios of gold foils for thicknesses ranging from approximately 2 to 80 mg/cm^2. Foil thickness correction factors are presented both graphically and in tabular form, which would be valuable for the determination of the ratio of epithermal to thermal neutron densities. Some discussions on the components of the correction factor are also included here. Measurements in the core of JRR-1 are presented and the total epithermal neutron density is determined to be 0.10 times the thermal one. (auth)

23496

ANGULAR DISTRIBUTION OF n-p SCATTERING AT 14.1 MEV. Teruo Nakamura (Kyoto Univ.). J. Phys. Soc. Japan 15, 1359-66(1960) Aug. (In English)

The angular distribution for the scattering of neutrons by protons was obtained at 14.1 Mev by observing the recoil protons with the use of a counter telescope consisting of a polyethylene target, two proportional counters, and a CsI scintillator. The data obtained at scattering angles of 165, 146, 118, and 89° in C.M. system were given with statistical errors of about 1%. The ratio of the cross sections at 180 and 90° in the center-of-mass system was found to be 1.080 ± 0.016 from a least square fit to the form $A + B \cos^2 \theta$. Therefore, it may be concluded that anisotropy of the angular distribution is confirmed quite clearly. The absolute values of differential cross sections at various angles were normalized using the total cross section 689 ± 5 mb measured by transmission. The values are in good agreement with the results predicted from the nuclear potentials with one-pion-exchange-tail. (auth)

23497

ON THE WEAK INTERACTION OF BARYONS. Seitaro Nakamura (Tokyo Univ.). J. Phys. Soc. Japan 15, 1543-4 (1960) Aug. (In English)

Baryons and pions are arranged in a triplet and singlet electric charge system. The Hamiltonian of the weak interaction between baryons and pions is described in terms of four-dimensional isospin space invariants, and a symmetry transformation is adapted for changing the sign of the electric charge of particles without converting them to antiparticles. The final Hamiltonian gives several predictions confirmed by experimental observations, e.g., parity is conserved in $\Sigma^- \rightarrow \pi^- + n$ and $\Sigma^+ \rightarrow \pi^+ + n$, while it is violated in $\Sigma^+ \rightarrow \pi^0 + p$, $\Lambda \rightarrow p + \pi^-$, and $\Lambda \rightarrow n + \pi^0$. (D.L.C.)

23498

DISCRIMINATION BETWEEN STRONG AND WEAK INTERACTIONS. Yasuhisa Murai (Saitama Univ., Urawa, Japan). Nuclear Phys. 17, 529-47(1960) July (2). (In English)

A discrimination between strong and weak interactions is made on the basis of a five-dimensional theory in which fermions are represented by eight-component spinors. The operators representing hyperonic charge and chirality are formed and it is shown how strangeness, as derived from them, can give a measure of the strength of the interaction. The type of coupling is determined, though this depends on the assignment of new characteristics to the particles. (auth)

23499

INVARIANCE AND THE S-MATRIX. S. Kamefuchi (Imperial Coll. of Science and Tech., London) and Y. Takahashi. Nuclear Phys. 17, 686-94(1960) July (2). (In English)

The transformation property of the state vector in the interaction picture is examined. The invariance condition is relaxed by requiring the invariance of the S-matrix only. (auth)

23500

TIME DEPENDENT NEUTRON SPECTRA. Juan Koppel (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 8, 157-63(1960) Aug.

The time-dependent slowing down of neutrons against free nuclei at rest was studied in the space independent case. New approximate and exact solutions for constant scattering and 1/v or constant absorption cross section were obtained and compared with previously reported work. (auth)

23501

ON THE DOUBLE COMPTON PROCESS AND SOME CALCULATIONS OF POLARIZATION EFFECTS. [PART] II. M. Carrassi and G. Passatore (Università, Geneva and Istituto Nazionale di Fisica Nucleare, Geneva). Nuovo cimento (10) 16, 811-28(1960) June 1. (In English)

Using a method already developed, the transition amplitudes among the basic polarization states of all particles involved in the double Compton effect were deduced and numerically calculated. The cross section and various polarization effects are discussed. The cross sections as a function of the energy of one of the emitted photons show in general an infrared divergence at the ends of the spectrum, a forward concentration with the increase of the incident energy, and in the case of a symmetric geometry for the two photons, a minimum when the energies of the emitted photons are nearly equal. Some effects of linear and circular polarizations were considered in detail and a comparison with the single Compton effect was made. Linear polarization effects show some qualitative difference from the single Compton scattering. (auth)

23502

THE ELASTIC AND INELASTIC SCATTERING OF NEGATIVE K-MESONS BY FREE PROTONS FOR ENERGIES TO 90 MEV. H. Göing (Max-Planck-Institut für Physik und Astrophysik, Munich). Nuovo cimento (10) 16, 848-60(1960) June 1. (In German)

The total and differential cross sections for elastic and inelastic scattering of negative K-mesons from free protons for energies to 90 Mev in nuclear emulsions were determined. The track length followed is 671.78 m. The differential cross sections show that S-scattering suffices for the description of these processes and Coulomb-scattering can be neglected for the angles considered (>20°). A simple theory was employed for the description of these interactions and a phase-shift-analysis carried out for both possible isotopic spin states ($T = 0$ and $T = 1$). It turns out that absorption and shadow-scattering in the state $T = 0$ is greater than in the state $T = 1$. The scattering length calculated was used to calculate the cross sections at high energies. They agree very well with experimental values. (auth)

23503

REMARKS ON THE APPEARANCE OF GHOST STATES IN RELATIVISTIC FIELD THEORIES. E. Ferrari (Università, Rome) and G. Jona-Lasinio. Nuovo cimento (10) 16, 867-85(1960) June 1. (In English)

A subtraction procedure to eliminate ghosts from propagators recently proposed by Redmond is examined from the standpoint of axiomatic field theory. This procedure is found to be equivalent to the introduction of a special vertex function which in principle can be chosen among functions having the analyticity properties prescribed by the axioms. This situation is shown to exist both in the case of boson and fermion fields. In the discussion Lehmann integral representation of propagators is taken as an axiom by itself. The modifications brought into the discussion of ghost problems by a subtracted Lehmann dispersion formula are then examined. Of some interest are the consequences on the high frequency behavior of form factors. (auth)

23504

NEW SEMIPHENOMENOLOGICAL PROTON-PROTON POTENTIAL. R. A. Bryan (Univ. of Rochester, N. Y.). Nuovo cimento (10) 16, 895-902(1960) June 1. (In English)

A static plus spin-orbit proton-proton potential model was derived semiphenomenologically. The potential resolves asymptotically to the one-pion-exchange potential and is fixed in the region within $r = 1.5\hbar/\mu c$ by matching the 310 Mev MacGregor-Moravcsik-Stapp phase shift solution No. 1. The resulting potential gives an improved fit to the p-p scattering data for the 40 to 310 Mev energy range. (auth)

23505

EFFECT OF A PION-PION SCATTERING RESONANCE ON LOW ENERGY PION-NUCLEON SCATTERING. J. Bowcock, W. N. Cottingham, and D. Lurié (European Organization for Nuclear Research, Geneva). Nuovo cimento (10) 16, 918-38(1960) June 1. (In English)

From the analytic properties of the pion-nucleon scattering amplitude postulated by Mandelstam, a fixed momentum transfer dispersion relation was derived in the energy variable which should be valid at low energies. This formulation allows the evaluation of the effect of a two-pion scattering resonance on pion-nucleon scattering. By a suitable choice of the pion-pion resonance parameters it was possible to fit both the experimental pion-nucleon phase shifts and the nucleon electromagnetic form factors. (auth)

23506

POSSIBLE INTERPRETATION OF AN UNUSUAL HYPERON DECAY. C. M. Garelli, B. Quassiati, and M. Vigone (Universita, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 16, 960-2(1960) June 1. (In English)

An unusual hyperon decay was observed during a study of the interactions of 1.15 Bev/c K^--mesons in an emulsion stack. The interaction results in a star with four evaporation tracks, a π^- of 21 Mev kinetic energy that comes to rest producing a σ-star, and a hyperon decaying in flight. Measurements made on the primary and secondary tracks are tabulated. The discussion of the interpretation of the event includes the subjects of the two-body decay of a particle of hyperonic mass, the interaction of a $\Sigma^\pm$-hyperon, and the radiative decay of a Σ^+. (B.O.G.)

23507

SOME ASPECTS OF PARTICLE MIXTURE OF STRANGE PARTICLES. S. Okubo (Università, Naples). Nuovo cimento (10) 16, 963-5(1960) June 1. (In English)

It is pointed out that certain types of contact interactions (e.g., $\bar{\Lambda}$-n) can be transformed into new interactions that correspond to the direct decay of the particle involved (e.g., $\Lambda \to p + \pi$) by a simple transformation. The treatment is essentially the same as that for the $\mu \leftrightarrow e$ case given by Cabibbo and Gatto and by Fainberg et al. This procedure is not completely self-consistent since the transformed interaction equation will give the transition $\Lambda' \leftrightarrow n'$ again. It is emphasized that the subtraction of the effective interactions from the Feynman diagrams is almost analogous to those of self-energy and charge-renormalization terms, but the procedure for the former is ambiguous; thus, the theory is somewhat arbitrary. Procedures are carried out for the transitions $\Sigma^+ \leftrightarrow p$ and $\Sigma^0 \leftrightarrow n$ similarly to that for $\Lambda \leftrightarrow n$. (B.O.G.)

23508

CP INVARIANCE AND NON-LINEAR PION INTERACTIONS. V. Gupta and S. N. Biswas (Tate Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 16, 971-2(1960) June 1. (In English)

It was recently shown that the requirement of invariance under CP and charge symmetry results in a parity conserving π-N interaction. The neutral pion and charged pion interactions were treated separately. An investigation was made to establish whether or not non-linear (in the pion field) interactions are also parity conserving. The non-linear n-p interaction becomes parity conserving under the requirements of CP invariance and charge symmetry. The general n-n and p-p parity violating, non-linear interaction Lagrangian (with scalar and pseudoscalar couplings only) becomes, as in the linear case, parity conserving. The requirement of charge symmetry, in this case, serves to relate the coupling constants; thus, both linear and non-linear pion interactions are permitted with fermion isotopic doublets. (B.O.G.)

23509

ON THE CONNECTION BETWEEN SCATTERING AND PHOTOPRODUCTION OF PIONS AT HIGH ENERGIES. C. Pellegrini (Comitato Nazionale per le Ricerche Nucleari, Rome) and L. Tau. Nuovo cimento (10) 16, 973-5 (1960) June 1. (In English)

Measurements of cross sections for $\pi + N \to N + \pi$ and

$\gamma + N \rightarrow N + \pi$ reactions were extended to energies in which two pion processes contribute significantly. A formula is derived which takes these processes into account. Experimental results are too scarce to allow a numerical evaluation of the equation; however, application of the usual rules for the addition of angular momenta values indicate validity. (B.O.G.)

23510

MARKOFF CASCADES WITH GENERAL SOURCE TERMS. J. W. Gardner (English Electric Co., Ltd., Whetstone, Leics, Eng.). Nuovo cimento (10) 16, 977-90(1960) June 16. (In English)

The longitudinal development of the multiplicative cascade, considered as a generalized Markoff process, is presented for the case in which the source is not necessarily a δ-function of space or energy. Last collision diffusion equations are established and formally solved, and practical applications are discussed. In addition to its traditional application to cosmic radiation theory the Markoff cascade has important applications to the theory of nuclear reactors. (auth)

23511

ELECTRON PAIR CREATION IN $\pi^- + p$ CAPTURE REACTIONS FROM REST. D. W. Joseph (Univ. of Chicago). Nuovo cimento (10) 16, 997-1013(1960) June 16. (In English)

Electromagnetic corrections are calculated for the processes $\pi^- + p \rightarrow n + e^+ + e^-$ and $\pi^0 \rightarrow \gamma + e^+ + e^-$. These corrections depend on the c.m. energy of the pair. For very low c.m. energy the corrections are relatively large, and due mainly to the electron-positron Coulomb attraction; they fall rapidly with increasing c.m. energy to a minimum of 0.5%, then rise slowly to a value of 1.7% at the highest c.m. energy. For both processes, the correction to the total rate amounts to about 1%. In terms of these total rates, the Panofsky ratio is found to be $R_P = 0.594\ P[\pi^- + p \rightarrow n + \pi^0, \pi^0 \rightarrow \gamma + e^+ + e^-]/P[\pi^- + p \rightarrow n + e^+ + e^-]$. For the process $\pi^- + p \rightarrow n + e^+ + e^-$, the problem of empirically identifying the contributions arising from interaction via the longitudinal component of the electromagnetic field and from size effects is discussed. These contributions are expected to amount to only 2.0 and 0.8%, respectively, of the total rate. The process $\pi^- + p \rightarrow n + 2\gamma$ is also discussed briefly. (auth)

23512

PRONG ANALYSIS OF MULTIPLE PRODUCTION OF PIONS AT BEVATRON ENERGY ACCORDING TO A STATISTICAL THEORY. F. Cerulus and J. von Behr (European Organization for Nuclear Research, Geneva). Nuovo cimento (10) 16, 1046-67(1960) June 16. (In English)

A model is proposed in which central collisions are treated according to a statistical theory and peripheral collisions according to a simple two-center model. The relative probability of the two kinds of collisions is introduced as a new parameter. With this one additional parameter it is possible to have agreement with the experimental values of the inelasticity, the average number of pions, the ratio of two- to four- to six-prong events, and the average energies. The introduction of a π-π isobar changes the result, but present experiments, because of lack of precision, cannot confirm or rule out this hypothesis. The model predicts also angular distributions and some angular correlations, as well as energy spectra. It is shown that a purely statistical model (without peripheral collisions) fails to account for the rather low inelasticity which is experimentally found, because it yields too high meson energies and much too low nucleon energies. (auth)

23513

ON PAULI'S TRANSFORMATION. J. M. Jauch (Office of Naval Research, London). Nuovo cimento (10) 16, 1068-72(1960) June 16. (In English)

It is shown that Pauli's transformation which mixes particle with antiparticle states is canonical but not unitary. It leads from one representation of the field operators to a new inequivalent one. (auth)

23514

PION PRODUCTION AND THE "ISOBARIC" MODEL. S. Bergia, F. Bonsignori, and A. Stanghellini (Università, Bologna). Nuovo cimento (10) 16, 1073-84(1960) June 16. (In English)

A model is proposed in order to take into account interference effects between different (33) isobaric channels in pion production. Within the one Bev energy region the qualitative features of the Lindenbaum and Sternheimer isobaric model are confirmed. At lower energies the interference modifies radically the isobaric spectra. (auth)

23515

A COMPACT EXPRESSION FOR S-MATRIX ELEMENTS IN THEORIES WITH SEVERAL INTERACTING FIELDS. F. R. Halpern (Università, Naples). Nuovo cimento (10) 16, 1085-91(1960) June 16. (In English)

A compact method of expressing the n-th order S-matrix element in quantum electrodynamics has been given by Caianiello. The generalization of this formula to n-interacting fields of arbitrary character is considered. The specific example of the quantum electrodynamics of spin-0 mesons is treated. Although only two fields are present there are several interactions because of the e^2 term in the current and because of the meson-meson renormalization term. Using these methods a new demonstration is given of the theorem that the terms in the expansion of the S-matrix that depend on the orientation of a family of space-like surfaces vanish identically. (auth)

23516

ANGULAR DEPENDENCE OF POLARIZATION IN p-p SCATTERING AT 970 Mev. PRELIMINARY RESULTS. R. J. Homer, G. W. Hutchinson, W. K. McFarlane, A. W. O'Dell, R. Rubinstein, and E. J. Sacharidis (Univ. of Birmingham, Eng.). Nuovo cimento (10) 16, 1132-4(1960) June 16. (In English)

The angular dependence of the asymmetry in p-p elastic scattering was investigated using a partially polarized 970-Mev proton beam. At this energy, the F wave contribution is expected to be considerable, and the resultant spin-orbit splitting of the phase shifts, if of the same sign, should reduce or change the sign of the asymmetry near 90°. The results indicate that the asymmetry changes sign at ~25° in addition to the expected reduction near 90°; the changes that would result from errors of $^1/_{10}$ and $^1/_2$° in the central direction are estimated. Measurements were not made at angles smaller than 25°. The implications of the data are discussed. (D.L.C.)

23517

PRELIMINARY RESULTS ON THE INTERACTIONS IN PHOTOGRAPHIC EMULSION OF K^--MESONS AT 1.15 GeV/c. L. Culhane, D. Keefe, A. Kernan, J. Losty, and A. Montwill (University Coll., Dublin). Nuovo cimento (10) 16, 1135-8(1960) June 16. (In English)

A stack of 100 stripped emulsions were exposed to a separated 1.15-Bev/c K^- beam, $^1/_3$ of the exposure time in the direct beam and the remainder behind a 15-in. H_2 bubble chamber. The results of track and area scanning are given, and their implications for the beam composition and mean free paths of K^- are discussed. (D.L.C.)

23518

ON THE SUBSTITUTION LAW IN QUANTUM FIELD THEORY. D. Judge (University Coll., Dublin), H. Shimodaira, and Y. Takahashi. Nuovo cimento (10) 16, 1139-41(1960) June 16. (In English)

The validity of the substitution law is examined for quantum field theory with both bosons and fermions and without recourse to perturbation expansion. (This law is a quantitative equation for the related processes, $a + b + c \ldots \rightarrow \alpha + \beta + \gamma \ldots$ and $b + c \ldots \rightarrow \bar{a} + \alpha + \beta \ldots$, where $\bar{a}$ is the antiparticle of a.) Two assumptions are made for bosons: the free fields obey the relativistically invariant equations of motion and commutation relations, and the interaction hamiltonian density is a function of the positive and negative field operator frequencies and their finite derivatives. For fermions, it is assumed that their field functions occur only in even combinations. The substitution law is shown not to hold for Lee's model. (D.L.C.)

23519

A NOTE ON THE RELATIVE PARITY $p_{K\Sigma}$. A. P. Balachandran and N. R. Ranganathan (Univ. of Madras). Nuovo cimento (10) 16, 1142-3(1960) June 16. (In English)

Two methods are suggested for determining the sign of the K−Σ relative parity; the reactions used in these methods are the decay of polarized Σ^0 and $K^- + p \rightarrow \Sigma^0 + \gamma$. (D.L.C.)

23520

VALIDITY OF Q. E. D. IN μ PAIR PRODUCTION. G. Furlan and G. Peressutti (Università, Trieste, Italy). Nuovo cimento (10) 16, 1144-7(1960) June 16. (In English)

The question of whether $\mu^+\mu^-$ pair production in e^+e^- annihilation can be used to test quantum electrodynamics (QED) at short distances is examined. The cross section ratio, σ/σ_0, is shown to be dependent on the angle if, in the equation for $\sigma(\theta)$, Δ is not zero, and hence the $\mu^+\mu^-$ pair production can be used to test QED at distances of the order of 10^{-14} cm. (D.L.C.)

23521

REMARK ON THE τ^+ MESON DECAY. W. Alles (Università, Bologna). Nuovo cimento (10) 16, 1148-50(1960) June 16. (In English)

An explanation for the deviation of the π^+ and π^- energy spectra in the decay $\tau^+ \rightarrow \pi^- + 2\pi^+$ from those predicted by Dalitz for a spin-O K meson is offered which takes into account P wave as well as S wave interactions. The results agree well with the experimental distributions, and a value of −0.245 is yielded for β, the P to S wave ratio, indicating a ratio $m_-/m_+ = -2.97$ as compared with the experimental value of -3.1 ± 0.6. The β value is compatible with a K meson radius of about 1.4 pion Compton wave lengths. (D.L.C.)

23522

VIRTUAL PION EFFECTS IN LONGITUDINAL POLARIZATION AND SPECTRUM OF NEUTRONS FROM UNPOLARIZED μ^- ABSORBED AT REST. A. Bietti (Università, Rome). Nuovo cimento (10) 16, 1151-4(1960) June 16. (In English)

A qualitative estimate is given for the virtual pion effects in the spectrum and polarization of neutrons emitted from the absorption of unpolarized μ^- at rest. The work of Cini and Gatto is used as a basis with a Fermi gas model. The results are plotted together with those of Cini and Gatto, which represent pure axial vector coupling without virtual pion effects; the difference is seen to be small, especially at high energies. (D.L.C.)

23523

EXPERIMENTS BEING MADE AND PLANNED IN THE FRASCATI LABORATORY. G. Morpurgo (Università, Florence). Nuovo cimento (10) 16, Suppl. No. 1, 17-36 (1960). (In Italian)

The survey of the experiments being made at the Frascati Laboratory is divided into two parts. These are photomesonic processes and essentially electrodynamic phenomena. The photomesonic processes discussed are production of a meson at low energies, production of pions at high energy, production of pion pairs, production of new particles, and production of π^0 in the Coulomb field of the nucleus. The electrodynamic processes discussed are experiments with single photons and electrons, fixed barycenters, photoproduction of μ pairs, and form factors of complex nuclei. (J.S.R.)

23524

EQUATION OF STATE OF A BOSE-EINSTEIN SYSTEM OF PARTICLES WITH ATTRACTIVE INTERACTIONS. Kerson Huang (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 1129-42(1960) Aug. 15.

The equation of state in the grand canonical ensemble was calculated for a system of Bose-Einstein particles with hard-sphere repulsive interactions and weak long-range attractions. The energy levels used in this calculation were modified forms of those derived in an earlier paper. The calculation was carried out in the limit of no interactions, and attention was focused on the thermodynamic phases of the system. It was shown that the gross features of the equation of state of He^4 were reproduced. There were the phases gas, liquid I, and liquid II. The phase transition between gas and the two liquids were first order transitions. The transition terminated in a critical point. The transition between liquid I and liquid II was the Bose-Einstein condensation. Liquid II had a negative coefficient of thermal expansion. Across the transition between liquids I and II the specific heat was discontinuous in value. In the limit of no interactions, the critical point receded toward zero temperature, zero pressure, and infinite volume. (auth)

23525

NEUTRON SCATTERING BY FLUIDS AND THE LAW OF CORRESPONDING STATES. George H. Vineyard (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 119, 1150-3(1960) Aug. 15.

It was shown that the classical law of corresponding states implies correspondences in the time-displaced pair correlations of fluids and also in the cross sections for neutron and x-ray scattering. A measurement of the scattering at one temperature and pressure by one fluid of a class of fluids can thus be used to determine the scattering at corresponding temperatures and pressures of all fluids of the class. Other applications in the study of molecular fluids and in the separation of the self-correlation from the general correlation were pointed out. (auth)

23526

FERMI SURFACE AND SOME SIMPLE EQUILIBRIUM PROPERTIES OF A SYSTEM OF INTERACTING FERMIONS. J. M. Luttinger (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 119, 1153-63(1960) Aug. 15.

It was shown that certain analytical properties of the propagators of many-fermion systems led rigorously to the existence of sharp discontinuities of the momentum distribution at absolute zero. This discontinuity in the momentum distribution was used to define a Fermi surface for a system of interacting fermions. It was shown that the volume of this surface in momentum space was unaffected by the interaction. The same analytic properties were shown to lead, by direct statistical mechanical arguments, to simple expressions for the low-temperature heat capacity, the spin paramagnetism, and the compressibility of the system. These expressions were very analogous to the corresponding expressions for noninteracting particles. Finally, it was shown how the whole formalism could be generalized when an external periodic potential was present (band case). (auth)

23527

CORRECTION TO THE DEBYE-HÜCKEL THEORY. D. L. Bowers and E. E. Salpeter (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 119, 1180-6(1960) Aug. 15.

The problem of a gas of particles all of the same charge, imbedded in a neutralizing medium of uniformly distributed charge of the opposite sign, was considered in terms of classical statistical mechanics. If a dimensionless parameter ϵ, roughly the inverse of the number of particles contained inside a Debye sphere, is small compared to unity, the Debye-Hückel theory is a good first approximation. For this case the corrections in the next order in ϵ are derived for the potential of mean force and the interaction energy. It was shown how this correction has to be modified for very small particle separation. The expansion in powers of ϵ is not strictly a Taylor expansion and factors such as $\ln\epsilon$ appear in the higher terms. Methods were given for numerical calculation of some auxiliary functions even when the parameter ϵ is not small. (auth)

23528

ELECTRON SCATTERING IN HIGH MAGNETIC FIELD. Arnold H. Kahn (National Bureau of Standards, Washington, D. C.). Phys. Rev. 119, 1189-92(1960) Aug. 15.

Electrical conductivity in a strong magnetic field was calculated for the case of scattering by delta-function impurities. The impurity concentration was taken as being so sufficiently weak that collision broadening could be neglected. The scattering by an individual center was solved exactly, rather than by perturbation theory. As a result transition probabilities for an electron at the bottom of a Landau level vanished, rather than diverged. Expressions were given for the longitudinal and transverse conductivities in the oscillatory range and in the quantum limit range for degenerate and nondegenerate statistics. The relation of this theory to those employing collision broadening was discussed. (auth)

23529

APPROXIMATE RELATIVISTIC COULOMB SCATTERING WAVE FUNCTION. W. R. Johnson and C. J. Mullin (Univ. of Notre Dame, Ind.). Phys. Rev. 119, 1270-83(1960) Aug. 15.

A relativistic scattering wave function, which is valid to second order in αZ for all electron velocities, was developed. The wave function has as its dominant term the Sommerfeld-Maue function. The computational simplicity of the closed form Sommerfeld-Maue wave function was retained in this modified Sommerfeld-Maue function. Applications of the wave function to the calculation of cross sections for the scattering of polarized electrons and bremsstrahlung production at the short wave limit of the spectrum were given. A large first-order correction to the Sauter-Fano formula for the bremsstrahlung cross section was obtained. (auth)

23530

VARIATIONAL TREATMENT OF ELECTRON-HYDROGEN ATOM ELASTIC SCATTERING. Sydney Geltman (National Bureau of Standards, Washington, D. C.). Phys. Rev. 119, 1283-90(1960) Aug. 15.

The Hulthén-Kohn variational method was applied to the elastic scattering of electrons by hydrogen atoms. The trial function used was of a nonseparable form, which allowed for the virtual excitation of the 2s and 3s states, and contained a scaling parameter which was allowed to vary. The resulting scattering lengths and S, P, and D singlet and triplet phase shifts were compared with the results of other calculations, and reasons were given for expecting them to be of improved accuracy. (auth)

23531

ELASTIC SCATTERING OF 13.5- AND 15-MEV DEUTERONS BY NUCLEI. Nikola Cindro and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 1340-4(1960) Aug. 15.

15-Mev deuterons from the MIT cyclotron were elastically scattered by a number of elements, including Al, Ti, Fe, Cu, Ni, Rh, Pd, Sn (natural and monoisotropic), Ta, Au, and Pb. The angular distributions were measured in the MIT cyclotron; 24-in. scattering chamber, by means of a NaI(Tl) scintillation detector. The crystal was thick enough to stop 15-Mev deuterons but too thin to stop protons of the same energy. Thus measurements of the (d,d) cross sections for light elements were permitted in situations in which (d,p) reactions play an important role. The obtained distributions differed sharply from the Rutherford formula, $\sigma_c \propto \csc^4(\theta/2)$; most of them, especially those for medium and lighter elements, showed pronounced diffraction-like maxima and minima. The energy of the beam was degraded to 13.5 Mev and the angular distributions for Ni, Sn (natural), and Au was measured, which showed the same general characteristics. (auth)

23532

PHOTOPRODUCTION OF π^0 MESONS FROM HYDROGEN IN THE REGION 900 to 1200 MEV. H. E. Jackson, J. W. DeWire, and R. M. Littauer (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 119, 1381-4(1960) Aug. 15.

The reaction $\gamma + p \rightarrow \pi^0 + p$ was studied in three adjacent 100-Mev energy intervals between 900 and 1200 Mev and at pion center-of-mass angles of 47°, 90°, and 125°. The reaction was observed as a coincidence between the recoil proton and one of the photons from the meson's decay. The kinematics were determined by the energy of the incident photon and the angle of the recoil proton. The differential cross sections at the forward and backward angles showed pronounced maxima near 1050 Mev; whereas, the 90° cross sections decreased slowly with energy. The estimated total cross sections suggested a narrow maximum near 1050 Mev. These features were consistent with the previously proposed existence of a resonant state in the pion-nucleon system of total angular momentum 5/2. (auth)

23533

PROTON-ANTIPROTON ANNIHILATION IN PROTONIUM. Bipin R. Desai (Univ. of California, Berkeley). Phys. Rev. 119, 1385-9(1960) Aug. 15.

Using the model for the nucleon-antinucleon interaction proposed by Ball and Chew, the capture rates for the various eigenstates of protonium, the bound system of a proton and an antiproton were calculated. It was found that these rates depend sensitively on spin, isotopic spin, and total angular momentum eigenvalues of protonium, not just on orbital angular momentum, as was usually assumed. The average capture rates for the nS and nP states were $5.3 \times 10^{18}/n^3$ and $4.3 \times 10^{14}/n^3$ sec^{-1}, respectively. This P capture rate was two orders of magnitude larger than in the case of the ($K^- - p$) atom because of the relatively long range of interaction in the Ball-Chew model. The problem of the Stark effect collisions, studied by Day, Snow, and Sucher in connection with the ($K^- - p$) atom, was therefore re-investigated. Certain important effects which were not considered by these authors were studied. Rough calculations indicated that for protonium the capture would take place predominantly from S states. (auth)

23534

PION MULTIPLICITY IN NUCLEON-ANTINUCLEON ANNIHILATION. Bipin R. Desai (Univ. of California, Berkeley). Phys. Rev. 119, 1390-4(1960) Aug. 15.

In the annihilation problem the influence of the Ball-Chew model was considered, according to which, at low energies, only a few of the eigenstates of the nucleon-antinucleon system need to be considered. The effect of the selection rules that forbid certain pion multiplicities was thereby examined. The energies considered are 50, 140, and 0 Mev in the case of protonium—the bound system of a proton and an antiproton. To obtain the multiplicity, the Fermi statistical model was used with the Lorentz-invariant phase space, thus defining a new interaction volume. It was found that due to selection rules there was a substantial change in the number distribution of the outgoing pions. At 140 Mev and in the case of protonium the two-pion production was decreased considerably. The zero-prong events for the $p\bar{p}$ annihilation was suppressed by about a factor of two for annihilations at rest in the case of protonium compared to the corresponding events for annihilations in flight. The over-all average multiplicity was unchanged, however. The value of the newly defined interaction volume, in units of Fermi volume, for $p\bar{p}$ and $N\bar{p}$ annihilations (where N denotes an "average" nucleon) should be ~10 in order to fit the observed multiplicities. (auth)

23535

MOMENTUM AND ASYMMETRY SPECTRUM OF μ-MESON DECAY. Richard J. Plano (Columbia Univ., New York). Phys. Rev. 119, 1400-8(1960) Aug. 15.

The beta decay of the positive μ meson was studied using a liquid hydrogen bubble chamber in a magnetic field of 8800 gauss. An analysis of 9213 events used in the momentum spectrum yielded $\rho = 0.780 \pm 0.025$. This number included the internal radiative corrections and was compared directly with the 0.75 predicted by two component theory. The analysis of 8354 events used in the asymmetry spectrum gave for the magnitude of the asymmetry $|\xi| = 0.94 \pm 0.07$ and for the shape parameter $\delta = 0.78 \pm 0.05$. (auth)

23536

ANELASTICITY OF p-p COLLISIONS AT 2.7 BEV. W. M. Bugg and D. T. King (Univ. of Tennessee, Knoxville). Phys. Rev. 119, 1408-10(1960) Aug. 15.

By following the tracks of particles in a direction generally contrary to that of the incident 2.7-Bev proton beam, a series of observations interpreted as p-p collisions were made in nuclear emulsions. The angular and momentum distributions of particles outgoing from these interactions, and hence the relative occurrence of p-p collisions with different pion multiplicities, were in reasonable accord with foregoing work. An attempt was made to distinguish triple pion production processes from those of double production. Although the cm kinetic energy distributions for the respective production modes were markedly different, the corresponding anelasticity characteristics showed a general similarity. (auth)

23537

IMPLICATIONS OF THE INTERMEDIATE BOSON BASIS OF THE WEAK INTERACTIONS: EXISTENCE OF A QUARTET OF INTERMEDIATE BOSONS AND THEIR DUAL ISOTOPIC SPIN TRANSFORMATION PROPERTIES. T. D. Lee (Columbia Univ., New York) and C. N. Yang. Phys. Rev. 119, 1410-19(1960) Aug. 15.

Assuming that all weak interactions were transmitted through an intermediate boson field W, it was shown that the observed $|\Delta I| = \frac{1}{2}$ rule and the small observed mass difference between K_1 and K_2 led to the conclusion that there existed four W particles ($W^\pm$, W^0, and $\overline{W}^0$). Furthermore, a natural assignment of the isotopic spin transformation property of these W particles followed a dual scheme in which the W's behaved sometimes as $I = \frac{1}{2}$ and sometimes as $I = 1$ particles. Various experimental implications were discussed including neutrino capture experiments, strong collisions exhibiting apparent nonconservation of strangeness, and strong collisions with apparent lepton production. (auth)

23538

PARTIAL-WAVE DISPERSION RELATIONS FOR PION-NUCLEON SCATTERING. William R. Frazer (Inst. for Advanced Study, Princeton, N. J.) and Jose R. Fulco. Phys. Rev. 119, 1420-6(1960) Aug. 15.

Partial-wave dispersion relations for pion-nucleon scattering were derived from the Mandelstam representation. The symmetry of the representation was used to obtain expressions for the discontinuities across the unphysical branch cuts. These expressions involved scattering amplitudes for pion-nucleon scattering and for the process $\pi + \pi \rightarrow N + \bar{N}$. In the approximation of neglecting all but the nearest singularities, it was shown that the Chew-Low effective-range formula is a solution to the equations. (auth)

23539

μ-MESON DECAY INTO THREE ELECTRONS. M. Bander and G. Feinberg (Columbia Univ., New York). Phys. Rev. 119, 1427-9(1960) Aug. 15.

The decay $\mu^- \rightarrow e^- + e^- + e^+$ via internal conversion was computed using a phenomenological matrix element for the $\mu e \gamma$ interaction. The results were compared with present experimental limits for this process, and the results concerning the form factors in the matrix element were discussed. The energy distribution of the emitted electrons was also computed. (auth)

23540

PION-PION INTERACTIONS IN τ AND τ' DECAYS. R. F. Sawyer and K. C. Wali (Univ. of Wisconsin, Madison). Phys. Rev. 119, 1429-35(1960) Aug. 15.

The final-state interactions in τ and τ' decays of K^+ mesons were studied by means of a Mandelstam representation. It was assumed that only the S-wave pion-pion scattering amplitude was large enough to have an appreciable imaginary part. Coupled, linear, singular, integral equations were found for the amplitudes describing $K^+ + \pi \rightarrow \pi + \pi$ in the physical and unphysical regions. From the solutions to these equations the τ and τ' decay matrix elements may be constructed. In an approximation the equations were solved in terms of pion-pion phase shifts. Comparison with experiment was made using Chew and Mandelstam's solution of the corresponding nonlinear equations for $\pi - \pi$ scattering. Consistency with experiment was found for values of the coupling constant implying repulsive $T = 0$ and $T = 2$ phase shifts. Independently of the approximation, the equations showed that the implications in τ and τ' decay of the rule, $\Delta T = \frac{1}{2}, \frac{3}{2}$, were identical with those of the $\Delta T = \frac{1}{2}$ rule. Hence the energy spectra in τ' decay cannot be a critical test of the $\Delta T = \frac{1}{2}$ rule. Independently of the approximation, it was shown that the decay matrix element cannot be expanded in a series of integral powers of the pion kinetic energies. (auth)

23541

BARYON MASS SPECTRUM. Katsumi Tanaka (Argonne National Lab., Ill.). Phys. Rev. 119, 1436-41(1960) Aug. 15

It is assumed that the π-baryon interactions are universal and the K-baryon interactions account for the large mass differences between baryons. If all baryon spins are $\frac{1}{2}$ and K spin is zero, the (Σ,Λ) parity is even, the (Σ,Λ) mass difference can be neglected, and the present baryon spectrum and its isotopic spin assignments are correct. To all orders in the π-baryon coupling constant and to the second order in the K-baryon coupling constants, the essential feature of the observed mass spectrum can be obtained. The magnitudes of the K-coupling constants that yield this mass spectrum are crudely estimated. (auth)

23542

PROOF OF THE MANDELSTAM REPRESENTATION IN PERTURBATION THEORY. Richard J. Eden (Univ. of California, Berkeley). Phys. Rev. Letters 5, 213-15(1960) Sept. 1.

A proof is presented for the hypothesis that the Mandelstam representation for a scattering amplitude is valid for every term in the perturbation series. The proof applies to any system of interacting particles not having anomalous thresholds; this requirement is expressed by fourth-order mass conditions. (D.L.C.)

23543

EXPERIMENTAL METHODS OF NEUTRONOGRAPHY. (REVIEW). Yu. G. Abov and D. F. Litvin (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 3-15(1960) May-June. (In Russian)

Various methods for analyzing neutron structure are surveyed with emphasis on inelastic scattering techniques. The design and performance of spectrometers, double crystal diffractometers, and monochrometers are described. (R.V.J.)

23544

COLLISIONS INVOLVING THE CROSSING OF POTENTIAL ENERGY CURVES. D. R. Bates (Queen's Univ., Belfast). Proc. Roy. Soc. (London), A 257, 22-31(1960) Aug. 23.

The Landau–Zener formula for the transition probability at a crossing of potential energy curves is discussed. It is pointed out that the model used in the derivation has defects which make the range of validity of the formula much more restricted than is commonly supposed. (auth)

23545

NUCLEON-ANTINUCLEON INTERACTION IN THE NEW TAMM-DANCOFF APPROXIMATION. A. N. Mitra and R. P. Saxena (Muslim Univ., Aligarh, India). Proc. Roy. Soc. (London), A 257, 59-73(1960) Aug. 23.

The nucleon-antinucleon (N-$\bar{N}$) problem is formulated in the new Tamm–Dancoff approximation in the lowest order, and the integral equation for N-$\bar{N}$ scattering derived, taking account of both the exchange and annihilation interaction. It is found convenient to represent the N-$\bar{N}$ wave function as a 4×4 matrix, rather than the usual 16×1 matrix for the nucleon-nucleon wave function, and a complete correspondence is established between these two representations. The divergences associated with the annihilation interaction and their renormalization are discussed in detail in another paper (Mitra & Saxena 1960; referred to as II). The integra equation with the exchange interaction alone, is then separated into eigenstates of T, J, L, and S in the usual manner and the various phase shifts obtained. The results of II for the contribution of the annihilation term are then used to calculate the complete phase shifts from which the various cross sections (scattering and charge exchange) are derived. The results indicate that while the exchange term alone gives too small values for the total cross sections versus energy, inclusion of the annihilation interaction without renormalization effects makes the cross sections nearly three times larger than those observed. On the other hand, inclusion of the finite effects of renormalization (which manifest themselves essentially as a suppression of the virtual meson propagator) brings down these cross sections to the order of magnitude of the observed ones. (auth)

23546

RENORMALIZATION FOR NUCLEON-ANTINUCLEON INTERACTION. A. N. Mitra and R. P. Saxena (Muslim Univ., Aligarh, India). Proc. Roy. Soc. (London), A 257, 74-82 (1960) Aug. 23.

The divergences associated with the integral equation for nucleon-antinucleon (N-$\bar{N}$) interaction derived in the preceding paper (Mitra & Saxena 1960) are analyzed in detail. The problem is found to be quite similar to that discussed by Dalitz & Dyson (1955) in connection with the π-N problem. The part of the wave function representing the specific effects of the annihilation interaction is found to be expressed in terms of the so-called vertex operator and a meson propagator modified by self-energy effects. The vertex operator is then renormalized and the finite (observable) effects of this renormalization on the N-$\bar{N}$ wavefunction evaluated. It is found that, unlike the case of π-N scattering where two different renormalization factors are needed for describing s- and p-wave interactions, the present problem requires a unique renormalization constant covering both odd and even angular momentum states. (auth)

23547

METHOD FOR OBTAINING A COMPONENT OF APPROXIMATELY COLLIMATED FAST NEUTRONS IN A REACTOR. Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 31, 823-4(1960) Aug.

By locating a uranium slug in the reflector of a graphite reactor at the edge of the loading, an approximately collimated fast neutron flux is obtained which is at least twice the random background fast flux. The relative intensity of the collimated flux at the samples is determined by the separation between slug and sample. Close to the slug the directed flux is high and the collimation poor, and by increasing the separation, the collimation is increased but at the expense of intensity. The fast flux in the region where samples are located was determined using the U^{238} fast fission reaction. The spatial dependence of the directed flux can be approximated by an inverse square expression. (auth)

23548

A COMPARISON OF THE MAGNETIC INTERACTION OF PROTONS AND DEUTERONS. G. Laukien and F. Noack (Technische Hochschule, Stuttgart). Z. Physik 159, 311-32 (1960). (In German)

For the investigation of the magnetic interaction mechanism between nuclear and electron moments, the relaxation behavior of protons and deuterons in a constant magnetic field of about 7400 gauss was compared. The longitudinal and transverse relaxation times $T_{1,P}$ and $T_{2,P}$ or $T_{1,D}$ and $T_{2,D}$ of both nuclei were measured by pulse techniques in paramagnetic H_2O and D_2O solutions of various concentrations. As interaction partner the ions Fe^{3+}, Co^{2+}, Cr^{3+},

VO^{2+} (in neutral and acid solution), and Mn^{2+} were used. The measurements showed that in solutions in which $T_{1,P} \approx T_{2,P}$, the approximation $T_{1,D} \approx T_{2,D}$ is also valid. In such solutions the time constants of the deuteron relaxation is in agreement with theory $T_{1,2} \sim 1/\gamma^2$, which is about 40 times larger than the time constant for proton relaxation. In solutions in which the times T_2 are markedly shorter than the times T_1, values for the ratios $T_{1,D}/T_{1,P}$ and $T_{2,D}/T_{2,P}$ are found which lie definitely outside the theoretically predicted intervals, both over and under the intervals. The direction of the deviation is shown correlated with an opposite variation of the quotient T_1/T_2 in the sense that the occurrence of abnormally short deuteron relaxation times is connected with an increase of the ratio T_1/T_2 in the transition from proton to deuteron relaxation and is reversed. The measurements show that in the first-named substance (its relaxation behavior was shown as normal) the direct dipole-dipole coupling is outweighed. In the second substance group the spin exchange coupling gives a significant contribution to relaxation. From the experimental results it is concluded that the characteristic constant A of this indirect coupling is not, as theoretically expected, proportional to the gyromagnetic ratios of the interacting partner. A concentration anomaly of the transverse relaxation was noticed in concentrated solutions, and it was theoretically explained. (tr-auth)

23549

ENERGY LOSSES OF FAST μ-MESONS IN THICK LAYERS OF MATTER. M. I. Daĭon (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1668-72(1960) June. (In Russian)

If energy losses of μ-mesons in the ground are taken into consideration, it is found that a μ-meson spectrum previously measured underground (depth ~40 m water equivalent) agrees with the results of the corresponding measurements performed at sea level. (auth)

23550

THE ELASTIC γp-SCATTERING AT ENERGIES OF 40–70 MEV AND THE POLARIZABILITY OF THE PROTON. V. I. Gol'danskii, O. A. Karpukhin, A. V. Kutsenko, and V. V. Pavlovskaya (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 38, 1695-1707(1960) June. (In Russian)

The elastic γ-p scattering at 40 to 70 Mev energy was investigated and differential cross sections at 45, 75, 90, 120, 135, and 150° were determined. The results obtained were compared with the theory that considers the anomalous proton magnetic moment as well as the effects of mesonic cloud polarization. The cross section of γ-p scattering at 90° corresponds to a proton electric polarizability $\alpha_E = (11 \pm 4) \cdot 10^{-43}$ cm^3. As an addition to the experimental results, the dispersion relations are used, which allow one to obtain from the π-photoproduction data the value of the sum of electric (α_E) and magnetic (α_M) polarizabilities of proton: $\alpha_E + \alpha_M = 11 \cdot 10^{-43}$ cm^3. By using this value, the obtained experimental data correspond to the following values of the proton polarizabilities: $\alpha_E = (9 \pm 2) \cdot 10^{-43}$ cm^3, and $\alpha_M = (2 \mp 2) \cdot 10^{-43}$ cm^3. A mean-square fluctuation of the proton electric dipole length $(r^2)^{1/2} = (3.5 + 5) \cdot 10^{-14}$ cm corresponds to the electric polarizability value obtained. (auth)

23551

SEARCH FOR THE ρ^0-MESON AND A CHECK OF THE DISPERSION RELATIONS IN π N-SCATTERING. V. G. Zinov, A. D. Konin, S. M. Korenchenko, and B. Pontekorvo (Pontecorvo) (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1708-14(1960) June. (In Russian)

The total $\pi^-\rho$-interaction cross sections (σ_t^-) were measured with an accuracy of 1.5 to 2% for about 50 pion energies at 140 to 360 Mev. The pion energy was known to within ±1%. No anomalies in the energy dependence of σ_t^- were found which could indicate the existence of a ρ^0-meson with a mass in the interval of 270 to 410 Mev. The data are inconsistent with the energy value $E_2 = 650$ Mev for the second maximum in σ_t^- found by Frisch et al. but agree with the conclusion drawn by Brisson et al. that it should be located at a smaller energy ($E_2 \approx 610$ Mev). The data are in agreement with the dispersion relations for π^-p-scattering. It is demonstrated that the Puppi—Stanghellini problem as such no longer exists and that it arose as a result of inaccurate knowledge of the total $\pi^-\rho$-interaction cross section. (auth)

23552

SPECTRUM OF NEUTRONS FROM THE d + p REACTION. N. A. Vlasov, S. P. Kalinin, B. V. Rybakov, and V. A. Sidorov. Zhur. Eksptl'. i Teoret. Fiz. 38, 1733-7(1960) June. (In Russian)

Neutron spectra for the reactions H(d,n)2p at $E_d = 18.6$ Mev and D(p,n)2p at $E_p = 8.6$ Mev were measured at an angle of 0° by the time-of-flight technique. The spectrum shapes can be satisfactorily explained by pair interaction between the nucleons in the final state. (auth)

23553

RECURRENT CONSTRUCTION OF ANGULAR OPERATORS. [PART] I. Ya. Fisher and S. Chulli (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1740-50(1960) June. (In Russian)

A practical recurrent method is given for constructing angular operators which characterize the angular and spin dependences of the S-matrix. Only differential operations are employed in the method, and the Racah transformations and calculations involving Clebsch–Gordan coefficients can be avoided. The method permits the finding of angular operators of a given process providing the angular operators of a simpler process are known. A solution is given of the problem of how a set of angular operators will change if one initial and one final scalar particle are replaced by spin ½ particles. Practical formulas and examples are presented. (auth)

23554

MOTION OF NUCLEONS IN AN ANISOTROPIC OSCILLATOR POTENTIAL WITH ACCOUNT OF SPIN-ORBIT INTERACTION. D. V. Volkov and E. V. Inopin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian, SSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1765-70(1960) June. (In Russian)

A method is proposed for calculating the wave functions and energy levels of nucleons moving in an oscillating potential. The general case of a potential which does not possess axial symmetry but in which account is made of spin-orbit interaction is considered. An essential feature of the calculations is that use is made of smallness of the spin-orbit coupling constant. In the limiting case of a strongly deformed nucleus the solution can be obtained in a simple analytical form. Investigation of this solution indicates that the spin-orbit interaction significantly affects the axial symmetry of the nucleus. Thus the axially symmetric shape of the nucleus becomes more stable; it is the cause of the discontinuous nature of the transition from axial nuclei to nonaxial ones. (auth)

23555

ON THE SCATTERING OF THE TRANSVERSELY POLAR-

IZED FERMIONS. A. A. Sokolov and M. M. Kolesnikova (Moscow State Univ.). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1778-85(1960) June. (In Russian)

The elastic scattering of transversally polarized fermions is considered. It is shown that in the ultrarelativistic case, scattering of the longitudinally polarized fermions is characterized by the four-dimensional spin pseudovector while scattering of the transversally polarized ones is characterized by the four-dimensional intrinsic angular momentum tensor. In the latter case the interactions proportional to the matrices p_1 and p_2 leave the scattered fermions transversely polarized; conversely, when the interaction energy contains p_3 or p_4, the longitudinal component may appear after scattering (if the particle has a non-zero rest-mass). (auth)

23556

POLARIZATION OF ELECTRONS IN ELASTIC SCATTERING WITH ACCOUNT OF THE FINITE SIZE OF THE NUCLEUS. B. K. Kerimov and V. M. Arutyunyan (Moscow State Univ.). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1798-1802 (1960) June. (In Russian)

The scattering phase shifts and polarization of elastically scattered electrons are computed with consideration of the finite size of the scattering center. An expression for azimuthal asymmetry in double scattering was derived as well as a correction to the usual Mott formula due to the second and fourth nuclear-charge density moments. (auth)

23557

APPLICATION OF THE DISPERSION TECHNIQUE FOR INVESTIGATION OF THE SIMPLEST GREEN'S FUNCTIONS IN MESODYNAMICS. V. V. Malakhov, E. P. Rashevskaya, and V. Ya. Faĭnberg. Zhur. Ekseptl'. i Teoret. Fiz. 38, 1803-13(1960) June. (In Russian)

An approximate set of dispersion equations for meson and nucleon Green's functions and the vertex function was investigated in pseudoscalar charge-symmetrical mesodynamics. The asymptotic behavior of these functions which corresponds to infinite values of Z_2^{-1} and Z_3^{-1} was deduced in the case of weak coupling. (auth)

23558

TRANSITION RADIATION EMITTED BY A CHARGE INCIDENT AT AN OBLIQUE ANGLE. G. M. Garibyan (Inst. of Physics, Academy of Sciences, Armenian, SSR). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1814-16(1960) June. (In Russian)

Transition radiation emitted in the forward direction by a charge incident on the interface between two media at an oblique angle is considered. It is shown that the intensity of the radiation is almost independent of the angle of incidence of the particle, providing the angle is not close to a right angle. (auth)

23559

APPLICATION OF THE DISPERSION METHOD FOR INVESTIGATION OF THE SIMPLEST GREEN'S FUNCTIONS IN QUANTUM ELECTRODYNAMICS. V. D. Mur and V. D. Skarzhinskiĭ (Lebedev Inst. of Physics, Moscow). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1817-23(1960) June. (In Russian)

The dispersion relation technique is used to study the electron propagation function $G(\hat{p})$ and current matrix element $(0|\eta(0)|p'k)$ as functions of $p^2 = (p' + k)^2$. It is shown that in the two-particle approximation (no more than two particles in the intermediate state), the analytical properties of the investigated matrix element in relation to the variable p^2 lead to a Hilbert boundary problem which is then solved. Explicit expressions for the electron spectral propagation functions are derived in the indicated approximation and the asymptotic behavior of $G(\hat{p})$ and $\Gamma\mu(p,p'; k)$ for $-p^2 \to \infty$, $p'^2 = -m^2$ and k^2-0 is determined. (auth)

23560

BREMSSTRAHLUNG AT THE BOUNDARY OF A MEDIUM WITH ACCOUNT OF MULTIPLE SCATTERING. I. I. Gol'dman (Inst. of Physics, Academy of Sciences, Armenian, SSR). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1867-9(1960) June. (In Russian)

An investigation of the composition of bremsstrahlung appearing at the boundary of a medium with consideration of the Landau—Pomeranchuk—Migdal effect was carried out. (auth)

23561

POLARIZATION OF NUCLEONS SCATTERED ON NON-ZERO SPIN NUCLEI. Yu. P. Elagin. Zhur. Ekseptl'. i Teoret. Fiz. 38, 1870-1(1960) June. (In Russian)

The optical model was employed in an analysis of the polarization of nucleons scattered on nuclei possessing spins differing from zero. It is shown that, generally speaking, such nuclei yield additional polarization compared to nuclei possessing the same optical parameters but no spin. (auth)

23562

SOLUTION OF EQUATIONS FOR MESON-MESON SCATTERING AMPLITUDE IN THE ASYMPTOTIC REGION. A. A. Ansel'm (Leningrad Inst. of Physics and Tech.). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1887-90(1960) June. (In Russian)

The set of integral equations for the meson-meson scattering amplitude is solved. An integral equation for the amplitude which depends only on one variable is obtained as a direct mathematical corollary of this set. (auth)

23563

ON THE UTILIZATIONS OF NUCLEAR REACTION DATA IN STUDIES OF $\pi-\pi$ INTERACTIONS. Yu. D. Bayukov and G. A. Leksin. Zhur. Ekseptl'. i Teoret. Fiz. 38, 1907-8 (1960) June. (In Russian)

High-energy processes with small pulse transmission were analyzed for the purpose of applying the data in studies of $\pi-\pi$, $\pi-K$, and $K-K$ interactions and in particular in studies of π-meson production of π mesons. (R.V.J.)

23564

MEASUREMENTS OF THE RELATIVE NUCLEAR ACTIVITY OF π MESONS NEAR THEIR GENERATION POINT. B. S. Neganov, L. B. Parfenov, and A. A. Tyapkin (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1917-18(1960) June. (In Russian)

Correlations were made of measurements of nuclear activity of mesons produced at 90° on hydrogen nuclei by 6.60 Mev protons at distances of 2 to 4, 10 to 20, 21 to 23, and 106 to 115 cm from the point of generation. The electron method with a scintillation counter, supplemented by the method of congruent geometry, was used in the experiment. The nuclear absorption of mesons with mean energies from 100 to 70 Mev (the energy-range corresponds to meson of $K_{\pi 2}$ decay) was investigated. The slightly reduced nuclear energy of mesons is explained by π meson decay into μ mesons at one meter distance. The order of error of the measurements is about 15% for meson nuclear absorption cross sections at distances from 3 to 110 cm. (R.V.J.)

23565

MEASUREMENTS OF μ MESON SPIRALITY. A. I. Alikhanov, Yu. V. Galaktionov, Yu. V. Gorodkov, G. P. Eliseev, and V. A. Lyubimov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Zhur. Ekseptl'. i Teoret. Fiz. 38, 1918-20(1960) June. (In Russian)

The spirality of μ mesons was measured by a method based on cross sections of polarized μ mesons scattering on polarized electrons; the cross section depends on the mutual orientation of interacting particle spins. The number of σ showers produced by μ mesons was measured; the number of particles in the shower was $n \geq 2$. The events were recorded by a coincidençe scheme. One or two of the 500 μ mesons per minute generated showers with $m \geq 3$. 116,000 showers were recorded in which energies of the μ mesons producing the shower were 3 to 6.5 Bev. The results showed that for μ^+, the number of showers in a two-current triangle winding $S_+ = -(0.37 \pm 0.41)$; $S = (N_+ - N_-)/(N_+ + N_-)$. For μ^- $S_- = +(0.82 \pm 0.42)$, and for both charges $S_\pm = 0.58 \pm 0.29$. $S_{\text{theor.}} = 0.6$, which corresponds to 50% polarization. The effect corresponds to predicted V–A interaction theory, i.e., to the μ^+ meson left spirality. (R.V.J.)

23566
THE 3-J AND 6-J SYMBOLS. Manuel Rotenberg, R. Bivins, N. Metropolis, and John K. Wooten, Jr. Cambridge, Mass., Massachusetts Institute of Technology, 1959. 503p. $16.00.

The Wigner 3-j and 6-j symbols are given in tabular form, including entries for any parameter less than or equal to 8 units of angular momentum. Power-of-prime-factor notation is used to facilitate further computation. An introductory section is included which defines and discusses the properties and uses of the 3-j, 6-j, 9-j, and 12-j symbols. (B.O.G.)

23567
FORMAL THEORY OF SCATTERING PHENOMENA. A STUDY OF RECENT ACHIEVEMENTS IN MODERN SCATTERING THEORY. Monograph No. 7. Brussels, Institut Interuniversitaire des Sciences Nucléaires, [1960]. 279p. (In English)

A monograph is presented which treats scattering phenomena theoretically from the time-dependent and time-independent views. The interaction representation and the S-matrix formalism in quantum field theory are dealt with separately in the time-dependent formal scattering theory. It is written in such a manner that it is accessible to those with a limited knowledge of formalism. The discussion is presented on a general basis and is not concerned with special cases. (B.O.G.)

Nuclear Properties and Reactions

23568 CRP-936
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A SURVEY OF PUBLISHED VALUES OF ν IN THE FAST FISSION OF U^{238}. G. C. Hanna. June 1960. 6p. (TNCC (Can)23; AECL-1056). AECL.

Published values for ν of U^{238} at 3.2 Mev were collected and a straight mean of 2.80 ± 0.05 was obtained. (W.D.M.)

23569 CRRP-913
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
YIELDS AND EFFECTIVE CROSS SECTIONS OF FISSION PRODUCTS AND PSEUDO-FISSION-PRODUCTS. W. H. Walker. Mar. 1960. Includes Appendices: A. VARIATION OF AVERAGE CROSS SECTION PER FISSION WITH EPITHERMAL NEUTRON DENSITY. B. SHIELDING CORRECTIONS FOR FISSION PRODUCTS IN NATURAL URANIUM METAL RODS. S. A. Kusheriuk. 67p. (AECL-1054). AECL.

Yields and effective cross sections of fission products and pseudo-fission-products were calculated assuming a neutron energy distribution typical of an NRX rod. The variation of average cross section per fission with epithermal neutron density was studied. The effect of shielding by U^{238} resonances on the epithermal fission product absorption was estimated. (C.J.G.)

23570 JAERI-1008
Japan Atomic Energy Research Inst., Tokyo.
COMPOUND NUCLEUS FORMATION CROSS SECTION CALCULATED BY THE OPTICAL POTENTIAL. Report No. 8. Kichinosuke Harada, Atsushi Sugie, Haruo Imai, and Kinichi Moriguchi. Feb. 1960. 22p.

The cross section for compound nucleus formation was calculated for neutrons with the use of the standard optical potential. Dependence on the mass number and the angular momentum was looked for. The incident energy was taken to be 3.5 Mev. As the form of the imaginary part, two types, uniform and surface absorption, were assumed. The results showed no remarkable difference between the two. The calculations were made to get some physical insight into the low-energy neutron-nucleus interaction, and no detailed comparison with experimental data was made. (auth)

23571 NDA-2111-3(Vols. A, B and C)
Nuclear Development Corp. of America, White Plains, N. Y.
FINAL REPORT COVERING THE PERIOD DECEMBER 17, 1958–SEPTEMBER 30, 1959. Volume A. DIFFERENTIAL ELASTIC NEUTRON SCATTERING CROSS SECTION OF OXYGEN. H. Lustig. Volume B. CONTINUUM THEORY OF GAMMA RAY SPECTRA FOLLOWING INELASTIC SCATTERING. E. S. Troubetzkoy. Volume C. FAST NEUTRON CROSS SECTIONS OF IRON, SILICON, ALUMINUM, AND OXYGEN. E. S. Troubetzkoy. Nov. 1, 1959. 90p. Contract DA 18-108-405-CML-295.

Elastic scattering angular distributions of O are presented for neutron energies up to 18 Mev. Calculations for the determination of resonance parameters in the incident neutron energy region of 2.5 to 4.0 Mev are described. Neutron cross sections for Fe, Si, Al, and O are presented in tabular form for energies up to 18 Mev. A theory predicting gamma spectra following inelastic scattering of fast neutrons is derived on the basis of the continuum model. The problem is reduced to integrals over the solution of a fourth-order differential equation. (See also NDA-086-2). (auth)

23572 NP-9002
Sweden. Försvarets Forskningsanstalt, Stockholm.
ENERGY DISTRIBUTION OF THE GAMMA-DOSE FROM MIXED-FISSION-PRODUCTS FROM Pu^{239}. Bo Jung. Oct. 20, 1955. 27p. (B-127-F)

The differential and integral gamma dose distributions at a point three feet above a Pu^{239} source of mixed fission products were determined for 11 different times after fission. The time dependence of the total dose and three different mean energy values were also determined. The doses from scattered and unscattered photons were determined separately. (M.C.G.)

23573 NP-9003
Sweden. Försvarets Forskningsanstalt, Stockholm.
PRODUCTS OF SIMULTANEOUS FISSION. R. Björnerstedt, K. Löw, and S. Ulvönäs. July 10, 1956. 31p. (B-150-F)

Thermal-neutron fission of U^{235} and Pu^{239} was studied assuming that 10^4 atoms undergo fission simultaneously. From fission yields and decay chains, the decay rate of the different isotopes created in the fission were calculated as a function of time after fission. Isotopes with unknown decay schemes which might give appreciable contributions to the total γ spectra, computed for 11 different times, were listed in the respective diagrams. (M.C.G.)

23574 OOR-2543.2
North Carolina State Coll., Raleigh.
THEORETICAL EVALUATION OF THE VARIANCE FOR THE STATISTICAL CORRELATION METHOD FOR MEASURING DAUGHTER HALF-LIVES IN THE $10^{-4}-10^{-1}$ SECOND RANGE. PART I. Robert P. Kennel, Wesley O. Doggett, and Linus K. Han. July 1960. 75p. Contract DA-01-009-ORD-820.

The determination of half-lives in the 10^{-4} to 10^{-1} second range is considered for daughters in equilibrium with long lived parents without the count rate restrictions imposed on the usual delayed coincidence method by the occurrence of accidental coincidences. The variance and fractional standard deviation of the correlation measurement are theoretically evaluated for a radioactive source cascade with negligible background and constant source strength, and the variance is determined for background activity with no cascade present.

23575 SGAE-60/1B
Österreichische Studiengesellschaft für Atomenergie GmbH., Vienna.
ÜBERSICHT ÜBER DIE AKTIVIERUNG NICHT SPALTBARER ELEMENTE MIT NATÜRLICHER ISOTOPENZUSAMMENSETZUNG IM REAKTOR. (Report on the Activation of Non-fissionable Elements with Natural Isotopic Composition in Reactors). Maria Tisljar. Apr. 1960. 117p.

Tables are presented of neutron-activation data for nonfissionable elements in reactors. The information is intended for use in production of isotopes for radiation sources, determination of activation behavior of reactor materials, and estimations concerning isotope separation in mass separators. (T.R.H.)

23576 TID-6216
Illinois. Univ., Urbana.
THE MÖSSBAUER EFFECT. Harry Lustig. [1960]. 66p. OTS.

The recent discovery and several important applications of recoilless gamma-ray fluorescence are reviewed. The importance of the fluorescence technique and its limitations, before Mössbauer's discovery, are discussed. Mössbauer's pioneering experiments are briefly described and Lipkin's simple theoretical explanation of recoilless gamma emission is presented. From among the large number of recent experiments which make use of the Mössbauer effect, two groups are selected for discussion. The first is concerned with the discovery of nuclear and magnetic properties of Fe^{57}; the other with a test of the principle of equivalence in general relativity, by a measurement of the gravitational shift in the frequency of radiation. (auth)

23577 UCRL-5996
California. Univ., Livermore. Lawrence Radiation Lab.
PHOTODISINTEGRATION CROSS SECTION OF BERYLLIUM NEAR THRESHOLD. John M. Prosser and Walter John, Jr. May 12, 1960. 34p. Contract W-7405-eng-48. OTS.

The cross section for photoneutron production in Be^9 at energies of 1.692, 1.720, and 1.78 Mev was investigated using gamma sources. Neutron counting was by manganous sulfate bath and a long counter. Gamma counting was by a scintillation spectrometer consisting of a NaI(Tl) scintillation crystal and a 256-channel pulse-height analyzer. A theoretical treatment of the P $\rightarrow$ S transition near threshold using square-well potentials is presented. (auth)

23578
STATISTICAL PROPERTIES OF ATOMIC AND NUCLEAR SPECTRA. Charles E. Porter (Univ. of Minnesota, Minneapolis) and Norbert Rosenzweig. Ann. Acad. Sci. Fennicae. Ser. A VI, No. 44, 1-66(1960). (In English)

A brief survey was presented of the experimental data on the distributions of the neutron widths of nuclear fine-structure levels and of the nearest-neighbor spacings for both atomic and nuclear energy levels. Random-matrix models to predict these data were discussed both analytically (in all possible cases) and via Monte-Carlo machine calculations. Evidence from explicit atomic and nuclear model calculations was shown to support the statistical hypotheses suggested for the Hamiltonian matrix. On this basis it was found that it was possible to achieve a unified discussion of the underlying statistical properties of atomic and nuclear spectra, excluding collective phenomena of which the statistical behavior of the fission widths was the most prominent example. (auth)

23579
MEASUREMENTS OF n-γ COINCIDENCES IN THE REACTION ^{10}B(d,nγ)^{11}C. J. A. McDonell (Univ. of Melbourne), D. G. Sargood, J. R. Moroney, and J. R. Prescott. Australian J. Phys. 13, 99-115(1960) June.

The energies of some neutron groups leading to low excited states of C^{11} in the reaction B^{10}(d,nγ)C^{11} were measured. These lead to values of 4.3 ± 0.3 Mev and 6.53 ± 0.02 Mev for the energies of the second and fourth excited states, respectively. Gamma-ray spectra were also studied in coincidence with different neutron groups. Ground state transitions were observed from the second, third, and fourth excited states, together with cascade decays of the fourth excited state through each of the second and third. Deductions from these γ-ray spectra considerably reduce the number of spin possibilities which have been found for these levels by other workers. (auth)

23580
ALPHA-PARTICLES FROM THE REACTION ^{7}Li(p,γ)-^{8}Be(α)^{4}He. D. S. Gemmell (Australian National Univ., Canberra). Australian J. Phys. 13, 116-19(1960) June.

The α-particle spectrum from the reaction Li^7(p,γ)-Be^{8*}(α) He^4 was determined in coincidence with γ rays. The results indicate that, apart from the broad 2.9 Mev level, there are no additional levels between the ground state and 7 Mev with intensities greater than 3% of the 2.9 Mev level. It is shown that the shape of the 2.9 Mev level can be fitted satisfactorily by a dispersion formula if a large value for the reduced width of the level is assumed. (auth)

23581
THE CHARACTERISTIC ELECTRON ENERGY LOSS SPECTRA OF ALUMINIUM–MAGNESIUM AND ALUMINIUM–COPPER ALLOYS. C. J. Powell (Univ. of Western Australia, Perth). Australian J. Phys. 13, 145-52(1960) June.

The characteristic electron energy loss spectra of 1500 ev electrons scattered by aluminum-magnesium and aluminum-copper alloys were measured. A plasma and a lowered plasma energy loss were observed in the alloys, and it was found that surface oxidation caused the disappearance of the lowered plasma loss and the appearance of a new modified lowered plasma loss. Although the compositions of the evaporated alloy specimens were unknown, the three energy losses were observed to vary continuously between the values observed for the three elements. This continuous change can be interpreted in terms of the changing free electron density in alloys of varying composition. It is concluded that measurements of the characteristic loss spectra of alloys can differentiate between losses due to individual and collective electron excitation. (auth)

23582

CROSS SECTIONS FOR THE INTERACTION OF 14.5 Mev NEUTRONS WITH MANGANESE AND COBALT. E. Weigold (Australian National Univ., Canberra). Australian J. Phys. 13, 186-8(1960) June.

The cross sections for 14.5-Mev neutron reactions were investigated for Mn and Co by irradiating a disk of one of these metals sandwiched between Cu disks for times shorter than the half life of the activity to be measured and counting the γ rays from the sample in a shielded scintillation spectrometer. The results are as follows: (1) Cu^{65}(n,2n). The cross section relative to Cu^{63}(n,2n) is 1030 ± 95 mb. (2) Mn^{55}(n,2n). The cross section from the 0.84-Mev γ ray from Mn^{54} is 825 ± 185 mb. (3) $Mn^{55}(n,\alpha)$. The cross section from the 1.43-Mev γ ray from V^{52} β decay is 27 ± 5 mb. (4) Co^{59}(n,2n). The cross section from the decay of the 0.8-Mev activity is 855 ± 165 mb, and 45 ± 25% of the reaction gives the 9-hr Co^{58} isomer. (5) Co^{59}(n,p). From the γ rays following the Fe^{59} decay, the cross section is 80 ± 23 mb. (6) $Co^{59}(n,\alpha)$. The cross section relative to Cu^{65}(n,2n) is 29 ± 6 mb. (D.L.C.)

23583

RELATIVE INTENSITY OF THE 17.2 AND 14.3 Mev GAMMA RAYS FROM THE $^{7}Li(p,\gamma)^{8}Be$ REACTION. B. Mainsbridge (Australian National Univ., Canberra). Australian J. Phys. 13, 204-8(1960) June.

Measurements of the intensity ratio of the 17.6- and 14.8-Mev γ rays from the $Li^{7}(p,\gamma)$ reaction were extended to the region above the 441-kev proton energy (E_p) resonance. The results indicate a ratio ($I_{17.6}/I_{14.8}$) maximum of 2.30 ± 0.04 occurring at the 441-kev E_p resonance, a ratio decrease for $E_p > 441$ kev, and a relatively constant ratio of 0.54 ± 0.08 for $E_p > 800$ kev up to the second E_p resonance at 1,030 kev. In addition, the ratio was shown to be a function of the observation angle in the neighborhood of the resonances. (D.L.C.)

23584

HALF-PERIOD OF Th^{232}. Thomas A. Farley (Massachusetts Inst. of Tech., Cambridge). Can. J. Phys. 38, 1059-68(1960) Aug.

A redetermination of the half period of Th^{232} by ion chamber alpha particle spectroscopy was made. It was originally undertaken to check the possibility that an error in the half-period of Th^{232} is responsible for discrepancies in geological ages of rocks determined from Th/Pb ratios as compared with ages determined from U/Pb ratios. A gridded, pressurized 2 pi geometry ion chamber using an argon–methane counting gas was used as a detector for alpha particles emitted from thin layers of metallic thorium evaporated onto glass plates. The counting rate under the Th^{232} alpha peak was measured with a 256-channel pulse height analyzer, and corrections of about 1% were made for self-absorption and backscatter by the glass plate and counting gas. The samples were chemically analyzed for thorium content by a spectrophotometric method. The average half period for 12 samples is $T_{1/2} = 1.41 \times 10^{10}$ years, with a standard error of 1%. The result is in substantial agreement with the half periods of greater uncertainty already reported in the literature, and geological age discrepancies cannot be attributed to error in the half-period of Th^{232}. (auth)

23585

THE GAMMA-NEUTRON CROSS SECTION FOR F^{19}. J. D. King, R. N. H. Haslam, and W. J. McDonald (Univ. of Saskatchewan, Saskatoon). Can. J. Phys. 38, 1069-76(1960) Aug.

The $F^{19}(\gamma,n)F^{18}$ reaction was studied by irradiating teflon samples in the x-ray beam of a 25-Mev betatron and detecting the annihilation radiation emitted during the decay of the residual nuclei. The cross section shows maxima at 10.6 (very small), 12.4, 14.0, 16.1, 17.2, and 19.3 Mev. The peak at 12.4 Mev is possibly due to excitation of the last neutron in F^{19} with only a small disturbance of the core nucleons. The peaks at 14.0 and 19.1 Mev are interpreted as the components of a split giant resonance, indicating an intrinsic quadrupole moment, Q_0, of approximately 0.30×10^{-24} cm^2 for F^{19}. (auth)

23586

PENETRATION FACTOR IN ALPHA-DECAY. S. K. Dutta, T. K. Mitra, and N. C. Sil (Indian Assn. for the Cultivation of Science, Jadavpur, Calcutta). Indian J. Phys. 34, 205-10 (1960) May.

The penetration probability of α particles through a potential barrier was calculated by using the Lanczos method of solving the Schrödinger equation near the nuclear boundary. The Woods-Saxon potential was chosen for the nuclear field. The value of the half-life of Po^{214} calculated from this penetration factor was twice the experimental value. (auth)

23587

THE VALUE OF ν FOR FISSION SPECTRUM INDUCED AND SPONTANEOUS FISSION OF ^{238}U. Rudolph Sher (Brookhaven National Lab., Upton, N. Y.) and Jean Leroy. J. Nuclear Energy, Pt. A. Reactor Sci. 12, 101-7(1960) June.

The effective value of ν for U^{238} fission induced by a fission spectrum of fast neutrons was measured by the scattering technique and, much more accurately, by the coincidence technique. The result for the ratio of ν_{238}/ν_{235} (thermal) agreed with earlier values of comparable precision reported in the literature, and, when averaged with them, yielded a best value for this ratio of 1.160 ± 0.020. If ν_{235} (thermal) is 2.47 ± 0.03, the best value of ν_{238} (fission spectrum) is 2.86 ± 0.05. A probable explanation was suggested for the apparently high value of ν_{238} (3.5 ± 0.2) reported in an earlier experiment. The value of ν_{238} for spontaneous fission of U^{238} was also obtained. The result 2.10 ± 0.08 (based on ν_{235} (thermal) = 2.47) agreed with earlier values in the literature derived from separate measurements of neutron emission and spontaneous fission rates in U^{238}. (auth)

23588

INVESTIGATION OF THE INFLUENCE OF NEUTRINO RECOIL AND ELECTRON-NEUTRON CORRELATION IN β DECAY OF He^{6} USING A CLOUD CHAMBER. Gyula Csikai. Magyar Tudományos Akad. Mat. Fiz. Tudományok Osztályának Közleményei 8, 245-57(1958). (Translated from Referat. Zhur. Fiz. No. 6, 1959, abstract No. 12438).

In order that the β decay of He^{6} ($T_{1/2}$ = 0.85 sec) could be observed, $Be(OH)_2$ powder was placed in a cloud chamber. Directly before the exposure, a (Po + Be) neutron source was shot through a special air pipe with the aid of compressed air into the direct vicinity of the $Be(OH)_2$. The He^{6} was obtained from the reaction $Be^{9}(n,\alpha)$ He^{6}. A total of 2,000 photographs was obtained. Of these photographs 120 were such that it was possible to use them to measure either the energy of the electron and the electron-nucleus angle, or the energy of both the electron and the nucleus. The photographs were investigated stereoscopically and clearly showed the presence of the neutrino. Since the even nucleus He^{6} has zero spin, and Li^{6} has the experimentally-determined spin of unity, the change in spin during the transition $He^6 \rightarrow Li^6$ will be $\Delta I = 1$, so that according to the Gamow-Teller selection rules, either a tensor or axial-vector interaction (assuming parity to be conserved) can be expected. The experimental angular correlation electron-neutrino agrees best with that expected from the tensor variant. This conclusion confirms the results of Rusted and Rabi.

23589

ABSOLUTE MEASUREMENT OF γ-QUANTA. Teruo Nakamura, Kiyoji Fukunaga, Kunio Takamatsu, and Shinjiro Yasumi. Mem. Coll. Sci., Univ. Kyoto, Ser. A 29, 141-51 (1959) Sept. (In English)

Absolute measurement of γ quanta from the Li-p reaction was performed by Hough's method. By using this result, the efficiency of the γ monitor was calibrated and the Pb thick-walled G—M counter was also calibrated which was previously used in the laboratory. Discussions are given on the determination of the absolute number of γ quanta with the previous γ counter as well as on the absolute cross section values of (γ,n) reactions. (auth)

23590

INTERACTION OF BETA-DECAY AND SECOND FORBIDDEN SPECTRUM OF Cs^{137}. Toshio Katoh, Shuichiro Yamasaki, and Yasukazu Yoshizawa (Faculty of Science, Osaka Univ.). Nuclear Phys. 17, 548-62(1960) July (2). (In English)

The allowed as well as non-unique first forbidden β spectra and, in particular, the second forbidden spectrum of Cs^{137} are discussed taking account of parity non-conservation. From the consideration of Fierz terms in allowed as well as forbidden transitions, the two combinations STP and VA are treated separately. Though a linear combination of the five interactions is possible, no interference term between STP and VA exists. In the discussion of non-unique first forbidden transitions the combination VA is more favorable than STP. From the second forbidden spectrum of Cs^{137} it is seen that

$$\frac{\mathrm{Re}(C_X C_{Y*} + C'_X C'_{Y*})}{|C_Y|^2 + |C'_Y|^2} \approx -\frac{|C_X|^2 + |C'_X|^2}{|C_Y|^2 + |C'_Y|^2}$$

where X and Y means S and T, or V and A. (auth)

23591

THEORY OF RADIATIVE CAPTURE IN THE RESONANCE REGION. A. M. Lane and J. E. Lynn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 17, 563-85(1960) July (2). (In English)

Starting from nuclear dispersion theory, a formalism is presented for the analysis of capture reaction cross sections at energies in the resonance region. Account is taken not only of capture through local resonances but also of "direct" or "potential" capture. The latter contributes to the cross section a smooth background with which resonances interfere. Estimates show that, in certain favorable cases, the direct capture can predominate. An important feature of direct capture (and also of the channel contribution to resonance capture) is that it tends to select final single particle states and so gives rise to anomalous groups in the photon spectrum. (auth)

23592

ANOMALOUS RADIATIVE CAPTURE IN THE NEUTRON RESONANCE REGION: ANALYSIS OF THE EXPERIMENTAL DATA ON ELECTRIC DIPOLE TRANSITIONS. A. M. Lane and J. E. Lynn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 17, 586-608 (1960) July (2). (In English)

A semi-quantitative attempt was made to analyze one of the most striking systematic features of low-energy neutron-capture γ-ray spectra, namely, the strong group of high energy transitions occurring in the spectra for nuclei below mass 208 and around mass 50. This is anomalous in the sense that it does not concur with our qualitative expectations from statistical theory. It is found that close to the giant resonance in the s-wave neutron strength function at A ≈ 50 the anomaly appears to be associated with a selection rule operating in resonance capture while for lighter nuclei and for capture in some of the lead isotopes there is strong evidence that it is a consequence of "direct" or "potential" capture. (auth)

23593

ALPHA-PARTICLE EXCITATION OF QUADRUPOLE AND OCTUPOLE SURFACE MODES IN Ti, Fe, Ni, Zn, AND Sr. D. K. McDaniels, J. S. Blair, S. W. Chen, and G. W. Farwell (Univ. of Washington, Seattle). Nuclear Phys. 17, 614-40(1960) July (2). (In English)

Angular distributions were obtained for elastic and inelastic scattering of 41 Mev alpha particles by Ti^{48}, Fe, Ni, Zn, Zn^{64}, and Sr. In all targets, excitation by inelastic scattering is strongest for the low-lying 2^+ levels, usually described in terms of quadrupole surface vibrations, and for the "anomalous" levels of somewhat higher excitation. The results for both elastic and inelastic scattering are analyzed in terms of a strong absorption diffraction scattering model. Parameters associated with collective interpretations of both types of levels are estimated and compared with values of the corresponding quantities derived from Coulomb excitation and electron scattering experiments. Reasonable agreement is obtained in the quadrupole excitation analyses. Strong support is given for 3^- assignments for the anomalous levels and for their interpretation in terms of surface octupole vibrations. (auth)

23594

DIFFRACTION ANALYSIS OF ELASTIC AND INELASTIC SCATTERING BY MAGNESIUM. J. S. Blair, G. W. Farwell, and D. K. McDaniels (Univ. of Washington, Seattle). Nuclear Phys. 17, 641-54(1960) July (2). (In English)

Angular distributions for elastic scattering by Mg and inelastic scattering proceeding to the 1.37 Mev 2^+ state in Mg^{24} were measured for alpha particles of 41, 34, and 28 Mev incident energy and for deuterons of 21 Mev incident energy. These results as well as those obtained previously by other workers were analyzed in terms of a diffraction scattering model. This model predicts that the elastic and inelastic differential cross sections, if divided by k^2, should each follow a single function of $2kR_0 \sin \frac{1}{2}\theta$ for all energies of the incident particles. Reasonable agreement between calculated and observed universal curves for alpha particle scattering lends support to this model. Normalization of the experimental and theoretical universal curves for inelastic scattering leads to a value for the absolute magnitude of the equilibrium deformation parameter $|\beta_2|$ of 0.24. (auth)

23595

THE ANOMALOUS INELASTIC SCATTERING OF ALPHA PARTICLES. M. Crut, D. R. Sweetman, and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Nuclear Phys. 17, 655-83(1960) July (2). (In English)

A series of experiments were carried out to establish and identify the properties of the so-called anomalous states in medium-weight nuclei. These excitation energies for states are about 4 Mev for nuclei with $Z \leq 29$ and in the range of 2 to 3 Mev for nuclei with higher Z. From a combination of angular distribution and correlation data interpreted by means of inelastic diffraction scattering analysis, the anomalous states were shown in several cases to be consistent with a 3^- interpretation. This lends credence to their collective interpretation. The difficulties with such analyses are discussed, and experimental procedures are given in some detail. (auth)

23596

HALF LIFE OF FIRST EXCITED STATE OF B^{10}. S. Gorodetzky, R. Richert, R. Manquenouille, and A. Knipper (Institut des Recherches Nucléaires, Strasbourg). Nuclear Phys. 17, 684-5(1960) July (2). (In French)

The half life of the 720 kev state of B^{10} was measured by means of a fast time-to-amplitude converter. The observed value is $T_{1/2} = (6.2 \pm 0.3) \times 10^{-10}$ sec. (auth)

23597

THEORETICAL APPROACH TO THE LOW ENERGY SPECTRUM OF Mo^{93}. M. Bouten (Interuniversitair Instituut voor Kernwetenschappen, Mol, Belg.). Nuclear Phys. 17, 695-8(1960) July (2). (In English)

The energy levels of Mo^{93} were calculated by considering three nucleons outside a spherical core. The interaction potential was taken to be of zero range. The level ordering was in good agreement with the experimental low-energy spectrum. The question of whether Mo^{93m} had spin $^{21}/_2$ or $^{23}/_2$ seemed to be settled in favor of the first value. (auth)

23598

THERMAL NEUTRON CROSS-SECTION MEASUREMENTS OF U^{233}, U^{235}, Pu^{240}, U^{234}, AND I^{129} WITH THE ORNL FAST CHOPPER TIME-OF-FLIGHT NEUTRON SPECTROMETER. R. C. Block, G. G. Slaughter, and J. A. Harvey (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 8, 112-21(1960) Aug.

The neutron total cross sections of U^{233}, U^{235}, Pu^{240}, U^{234}, and I^{129} were measured with the new ORNL fast chopper time-of-flight neutron spectrometer over an energy range from approximately 0.02 to 0.20 ev. The cross section data were fitted in the energy range from approximately 0.02 to 0.04 ev by the least squares method to the following equation: $(\sigma_T - \sigma_{sc}) = a/\sqrt{E} + b$ where σ_T and σ_{sc} are the total and scattering cross sections, E is the neutron energy, and a and b are the coefficients of fit. From this least squares fit, the 2200 m/sec neutron total cross sections of U^{233}, U^{235}, Pu^{240}, U^{234}, and I^{129} were determined to be 587 ± 3, 693 ± 5, 290 ± 8, 110 ± 4, and 35 ± 4 barns, respectively. A brief description of the new ORNL fast chopper time-of-flight neutron spectrometer is included. (auth)

23599

AGE OF Na–Be NEUTRONS IN WATER AND KEROSENE. D. Graham Foster, Jr. (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 8, 148-56(1960) Aug.

The age to indium resonance of nearly monoenergetic 0.97 Mev neutrons from spherical Na–γ–Be sources was measured in water and kerosene. The age from a point source was inferred by extrapolation from measurements made with sources $^3/_4$ and $^3/_8$ in. in diameter. The flux age was 13.9 ± 0.2 cm^2 in water and 13.8 ± 0.2 cm^2 in kerosene. Calculations by the moments method gave 13.9 ± 0.1 cm^2 in each medium, in excellent agreement with the measurements. The thermal migration area measured concurrently was 21.5 ± 0.4 cm^2 in water and 20.6 ± 0.4 cm^2 in kerosene. The migration area calculated from the resonance age was 22.2 ± 0.5 cm^2 in water and 21.8 ± 0.5 cm^2 in kerosene. Both of these were substantially larger than the measured values. (auth)

23600

SCATTERING OF THERMAL NEUTRONS IN GRAPHITE. P. G. Khubchandani (Atomic Energy Establishment, Trombay, India). Nuclear Sci. and Eng. 8, 172(1960) Aug.

Previous calculations of the total cross section of thermal neutrons in graphite were modified, taking into account contributions to neutron scattering only from the planes which gave x-ray reflections. Only 18 reflections of the expected 40 were obtained. Calculated results, using this method, coincided with the experimental points within 2%. (M.C.G.)

23601

NUCLEAR FISSION PRODUCES TRITIUM. E. L. Albenesius and R. S. Ondrejoin (E. I. du Pont de Nemours & Co., Aiken, S. C.). Nucleonics 18, No. 9, 100(1960) Sept.

Tritium was found to be a product of nuclear fission. For three types of material examined, a ratio of 1 to 2×10^4 fissions per tritium atom was observed. Eight samples of natural uranium, irradiated over an exposure of 300 to 1,600 Mwd/ton, gave a fission-to-tritium ratio of $(1.05 \pm 0.09) \times 10^4$. Tritium was measured by scintillation counting. About 25 % of the total tritium was found in the gas phase and the remainder in the solution after nitric acid dissolution of the uranium. (M.C.G.)

23602

ON THE GAMMA RAYS EMITTED IN THE DECAY OF $^{140}_{59}Pr$. S. Jha, R. K. Gupta, and H. G. Devare (Tate Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 16, 829-33(1960) June 1. (In English)

The γ rays from Nd^{140}-Pr^{140} were studied in a scintillation spectrometer. New γ rays of energies (900 ± 20), (1600 ± 30) and (2500 ± 50) kev were detected; their intensities in comparison to the 511 kev annihilation radiation are (0.15 ± 0.05)%, (0.50 ± 0.10)%, and (0.02 ± 0.01)%, respectively. The branching ratio from the decay of Pr^{140} to the ground state, 1600 kev state, and 2500 kev state of Ce^{140} were estimated from photon intensities to be 99%, ~1%, and ~0.2%, respectively, giving the value of log ft ~5 for all these branches. An assignment of 1^+ for Pr^{140} is suggested. (auth)

23603

β-γ ANGULAR CORRELATION IN ^{59}Fe AND PARITY CONSERVATION IN STRONG INTERACTIONS. E. Fuschini, G. Giacomelli, C. Maroni, and P. Veronesi (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 16, 886-94(1960) June 1. (In English)

Nuclear β decay leaves the residual nucleus partially polarized in the direction of emission of the β particle. If parity conservation in nuclear states is violated, an asymmetry about 90° of a β-γ directional correlation can be present (existence of a $\bar{\sigma}_{\text{nucleus}} \cdot \bar{p}_\gamma \alpha \cos\theta$ term). The asymmetry was looked for in a β-γ cascade of Fe^{59} and was found to be zero within one standard deviation of 0.3%. The bearing of this result on an upper limit for F is discussed (F is the relative amplitude of the irregular wave function with respect to the regular one). As a by-product, (63.1 ± 0.8) days for the lifetime of Fe^{59} was obtained. (auth)

23604

SURFACE EFFECTS IN (γ,n) AND (γ,p) REACTIONS. V. De Sabbata (Università, Ferrara, Italy) and A. Tomasini. Nuovo cimento (10) 16, 903-17(1960) June 1. (In English)

A study was made with the independent particles model of the contribution to photonuclear reactions by the surface of the nuclei; the angular distributions, in particular, were analyzed. The dipole approximation in the case of photoneutrons is good, so the angular distribution is symmetrical around $\pi/2$; the presence of an interference term between the transitions $l \rightarrow l+1$, $l \rightarrow l-1$ results in a possible minimum at $\pi/2$ instead of the usual maximum.

In the case of photoprotons, as this approximation no longer holds, the closed expression without any expansion in multipoles was considered; the angular distribution results are strongly asymmetrical. Numerical calculations were carried out at various energies for A = 16 and 40 and $r_0 = 1.2$ and 1.4. The cross section is of the order of 10^{-26} cm^2 and the ratio $\sigma(\gamma,p)/\sigma(\gamma,n)$ is of the order of unity. (auth)

23605

REACTIONS $Al^{27}(n,\alpha)Na^{24}$ INDUCED BY NEUTRONS OF 15.2 Mev. M. Cevolani, S. Petralia, B. Righini, U. Valdrè, and G. Venturini (Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 16, 950-7(1960) June 1. (In Italian)

The angular and energetic distribution of α particles from the $Al^{27}(n,\alpha)Na^{24}$ reaction at 15.2 Mev is determined. The particles were detected with Ilford C-2 and K-0 emulsions. The reaction chamber was designed so as to obtain a good angular definition (between 80 and 160°). The angular distribution results are remarkably anisotropic; the energetic distribution shows a great number of low energy particles. The temperature of the residual nucleus is calculated and the results obtained are discussed. (auth)

23606

MEASUREMENTS ON PICK-UP REACTIONS IN ^{31}P AND ^{32}S. L. Colli (Centro Informazioni Studi Esperienze, Milan), M. G. Marcazzan, F. Merzari, P. G. Sona, and F. Tonolini. Nuovo cimento (10) 16, 991-6(1960) June 16. (In English)

Experimental results on angular distribution of deuterons emitted in reaction $P^{31}(n,d)Si^{30}$ and $S^{32}(n,d)P^{31}$ are presented. The reactions are due to 14.1-Mev neutrons and only the transition to the ground state is considered. The results are consistent with the simple interpretation that the reaction take place through a pure pick-up process with zero angular momentum transferred to the residual nucleus. (auth)

23607

^{60}Ni (γ-γ) ANGULAR CORRELATION. J. B. Garg and N. H. Gale (The University, Manchester, Eng.). Nuovo cimento (10) 16, 1014-19(1960) June 16. (In English)

The Ni^{60} (γ-γ) angular correlation was remeasured using time-of-flight techniques. The results obtained are in close agreement with the theoretical correlation function for the γ-γ cascade transition: 4(E2)2(E2)0. The merits of the technique employed are discussed. (auth)

23608

STATISTICAL EMISSION OF NUCLEONS IN REACTIONS PRODUCED BY 14 Mev NEUTRONS. U. Facchini (Università, Turin), I. Iori, and E. Menichella. Nuovo cimento (10) 16, 1109-31(1960) June 16. (In English)

A certain number of nuclear reactions were analyzed for medium and light nuclei ($10 < Z < 40$), particularly (n,p) reactions with 14 Mev neutrons. The expression $n(\epsilon)/\epsilon\sigma^*$, which is proportional to the nuclear level density, is represented fairly well, for ϵ in the range 4 to 10 Mev, by an exponential law of the kind $e^{-\epsilon/\theta}$, where $\theta = 1$ to 1.2 Mev for medium nuclei ($20 < Z < 40$) and $\theta = 1.45$ for lighter nuclei. σ^* was calculated assuming $r_0 = 1.4 \cdot 10^{-13}$ cm for neutrons and $r_0 = 1.6 \cdot 10^{-13}$ cm for protons. On such a basis the ratio $\sigma(n,p)/\sigma(n,p_i)$ is in good agreement with the evaporative model when one considers the Q values of the reaction and the fact that the residual nucleus is even-even or odd-odd. From such ratio, calculated for even A nuclei, it is possible to obtain values of the pairing energy Δ in good agreement with that calculated by Cameron. Also for (n,2n), (n,np), and (p,n) reactions on medium nuclei, the evaporative model gives satisfactory results for the interpretation of the cross-section variations. (auth)

23609

THE ACTUAL SITUATION IN THE FIELD OF NUCLEAR REACTIONS AT INTERMEDIATE ENERGY. L. Colli (Centro Informazioni Studi Esperienze, Milan). Nuovo cimento (10) 16, Suppl. No. 1, 67-75(1960). (In Italian)

A brief discussion of the new data obtained on nuclear reactions at energies from a few Mev to several tens of Mev is presented. The mechanisms of direct effects are discussed. (J.S.R.)

23610

PRECISION DETERMINATION OF THE SLOW NEUTRON ABSORPTION CROSS SECTION OF B^{10}. G. J. Safford, T. I. Taylor, B. M. Rustad, and W. W. Havens, Jr. (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 119, 1291-4(1960) Aug. 15.

The total neutron cross section of B^{10} was measured at neutron energies between 0.00291 ev and 0.1 ev with the Columbia University crystal spectrometer. The B^{10} absorption cross section was obtained by subtracting the relatively small, known, scattering cross section from the measured total cross section. Two samples enriched to 92.84 ± 0.06 at.% and 99.88 ± 0.01 at.% B^{10} were used for these measurements. The B^{10} absorption cross section obtained with the 92.84% B^{10} sample followed the relation $E^{1/2}\sigma_a = 612.3 \pm 2.4$ barns ev$^{1/2}$ and yielded a value of 3849 ± 15 barns at 0.0253 ev. For the 99.88% B^{10} sample, the B^{10} absorption cross section obeyed the relation $E^{1/2}\sigma_a = 608.9 \pm 2.3$ barns ev$^{1/2}$ and gave a value of 3828 ± 15 barns at 0.0253 ev. A sample of Argonne-Brookhaven standard normal boron, 19.8 ± 0.1% B^{10}, was measured simultaneously. The resulting absorption cross section for normal boron was $\sigma_a(0.0253\ \text{ev}) = 764 \pm 3$ barns and obeyed the relation $E^{1/2}\sigma_a = 121.5 \pm 0.5$ barns ev$^{1/2}$. The average of the results for the two enriched samples yields $\sigma_a(B^{10}) = 3838 \pm 11$ barns at 0.0253 ev and $E^{1/2}\sigma_a(B^{10}) = 610.5 \pm 1.7$ barns ev$^{1/2}$. The ratio of the above values of the absorption cross sections for B^{10} and normal boron yields a value of 19.9 ± 0.1% B^{10} for the normal sample which is in good agreement with mass spectrometer determinations. (auth)

23611

SHAPE OF BETA SPECTRA OF ONCE FORBIDDEN TRANSITIONS IN THE DECAYS OF Ga^{72}, La^{140}, Eu^{152}, Eu^{154}, AND Sb^{124}. L. M. Langer and D. R. Smith (Indiana Univ., Bloomington). Phys. Rev. 119, 1308-14(1960) Aug. 15.

Magnetic spectrometer studies were made on the beta spectra of Ga^{72}, La^{140}, Eu^{152}, Eu^{154}, and Sb^{124}. The highest energy beta group of each of these transitions has an abnormally long comparative half life and probably is a once forbidden decay from a 3− initial state to a 2+ final state. The highest energy beta spectrum was found to have a nonstatistical, nonunique shape. On the assumption that the B_{ij} matrix element dominates the decay, the experimental shape factors were fitted empirically by $C = q^2 + \lambda p^2 + D$. The best fits were obtained for values of D equal to 15, 10, 5, 20, and 15 for Ga^{72}, La^{140}, Eu^{152}, Eu^{154}, and Sb^{124}, respectively. (auth)

23612

STUDY OF THE GAMMA-RAY AND INNER BREMSSTRAHLUNG TRANSITIONS IN THE DECAY OF TIN-113. Willie E. Phillips and John I. Hopkins (Vanderbilt Univ., Nashville). Phys. Rev. 119, 1315-21(1960) Aug. 15.

A fast-slow coincidence spectrometer was used to study the decay of Sn^{113}. A 650-kev gamma ray found in the single-channel spectrum was shown to be in coincidence with the InK x ray both in the fast and in the slow coincidence spectra. This confirmed the existence of a 650 kev level in In^{113} fed by a weak orbital capture branching. From the relative intensities of the 257 and the 650-kev gamma rays (16.4 ± 1.9 : 1), it was determined that the spin of the 650 kev level is $^5/_2$ and the parity is odd. The absence of positrons and arguments from log(ft) classifications indicate a spin of $^3/_2$ and even parity for the ground level of Sn^{113} and a decay energy in the range of 0.8 to 1.6 Mev. The shape of the corrected inner bremsstrahlung spectrum indicated a decay energy of 1.3 ± 0.3 Mev. (auth)

23613

INTERNAL CONVERSION ELECTRONS FOLLOWING COULOMB EXCITATION OF HIGHLY DEFORMED ODD-A NUCLEI. E. M. Bernstein and R. Graetzer (Univ. of Wisconsin, Madison). Phys. Rev. 119, 1321-30(1960) Aug. 15.

The internal conversion electrons emitted following Coulomb excitation of Eu^{153}, Dy^{161}, Dy^{163}, Ho^{165}, Tm^{169}, Lu^{175}, and Ta^{181} were measured. The relative intensities of the decay transitions from the first two rotational states of these isotopes were compared with the predictions of the rotational model of Bohr and Mottelson. In general, there was good agreement betwen the experiment and theory. However, the results for the Dy isotopes indicated some disagreement which was outside the experimental uncertainty. For Eu^{153}, Dy^{163}, and Lu^{175} transitions involving intrinsic states were observed in addition to the rotational transitions. The reduced E2 transition probabilities for these intrinsic transitions were appreciably larger than single-particle estimates. The first rotational state in Lu^{176} was observed with a natural Lu target. The data indicated that this transition was predominantly M1. (auth)

23614

NEUTRON TRANSFER AND THE TUNNELING MECHANISM IN THE BOMBARDMENT OF GOLD BY NITROGEN. J. A. McIntyre, T. L. Watts, and F. C. Jobes (Yale Univ., New Haven). Phys. Rev. 119, 1331-9(1960) Aug. 15.

Measurements were made of the angular distributions of N^{13} nuclei produced in the neutron-transfer reaction $Au^{197}(N^{14},N^{13})Au^{198}$. Fifteen different bombarding energies were studied. It was found that the results could be described in terms of the transfer of a neutron from an N^{14} nucleus moving along a classical trajectory. In particular, it was found that N^{14} trajectories with distances of closest approach of $(12.7 \pm 0.5) \times 10^{-13}$ cm gave the largest contribution to the transfer process. Further, both the angular and energy dependence of the N^{13} production were compared with the dependences predicted by the tunneling theory of Breit and Ebel. Both experimental dependences were found to be in agreement with this theory. (auth)

23615

INTERACTION OF HIGH-ENERGY PROTONS AND ALPHA PARTICLES WITH IODINE-127. Inge-Maria Ladenbauer and Lester Winsberg (Univ. of California, Berkeley). Phys. Rev. 119, 1368-75(1960) Aug. 15.

Iodine was bombarded with protons ranging in energy from 0.25 to 6.2 Bev and with 0.25-, 0.50-, and 0.72-Bev alpha particles. Reactions of the types (p,pxn), (p,2pxn), $(p,p\pi^+)$, $(p,p2\pi^+)$, $(p,n\pi^-)$, and $(\alpha,\alpha xn)$ to produce iodine, tellurium, antimony, and cesium isotopes were investigated. Upper limits in the range 0.01 to 0.1 mb were found for cross sections of reactions to produce Sb^{127} and Cs^{127}. For Te^{127}, upper limits in the range of 1 to 2 mb were found. These and other studies of reactions in which the product has the same mass number as that of the target were discussed in terms of the initial interaction. At all incident energies studied, the cross section for the formation of I^{126} via the (p,pn) or $(\alpha,\alpha n)$ reaction was significantly higher than that of the other (p,pxn) or $(\alpha,\alpha xn)$ reactions, with the possible exception of $(\alpha,\alpha 4n)$. The (p,pn) and probably the $(\alpha,\alpha n)$ reactions appear to be due primarily to knock-on collisions with surface neutrons. The excitation functions for the production of iodine isotopes by proton bombardment decrease between 0.25 and 0.72 Bev but remain relatively constant for higher energies. The (p,2pxn) reactions show a similar effect, but with the excitation functions becoming constant at about 2 Bev. These results are compared with Monte Carlo calculations of the proton-initiated nucleon cascade and of the subsequent evaporation of light particles. (auth)

23616

INTERACTION OF HIGH-ENERGY PROTONS WITH INDIUM. David R. Nethaway and Lester Winsberg (Univ. of California, Berkeley). Phys. Rev. 119, 1375-80(1960) Aug. 15.

Indium was bombarded with protons ranging in energy from 1.0 to 6.2 Bev. Reactions of the type (p,pxn), (p,2pxn), (p,p′), and $(p,p\pi^+)$ that produce isotopes of indium and cadmium were investigated. The excitation functions were constant within experimental error in this energy region with possible exceptions for Cd^{115} and In^{115m} at 1.0 Bev. These results were compared with two types of calculation. In one treatment, the nucleus was considered to be a degenerate Fermi gas of nucleons. The cross sections that were calculated with this nuclear model at 2 Bev were much smaller than the experimental values. There was good agreement at 1 Bev for nuclides with mass number less than 113. The second treatment took into account the shell structure of In^{115}. The latter calculation for the (p,pn) reaction was in good agreement with the experimental results at 4.1 and 6.2 Bev. The comparison of the experimental results with the calculated values was discussed in terms of the adequacy of the calculations. (auth)

23617

THRESHOLD EFFECTS IN THREE-BODY CHANNELS. Luciano Fonda (Inst. for Advanced Study, Princeton, N. J.) and Roger G. Newton. Phys. Rev. 119, 1394-9(1960) Aug. 15.

The possibility of obtaining threshold anomalies in reactions leading to three-particle channels was studied in detail. It was found that a threshold cusp or rounded step existed in reactions whose final three-body channels have at least one particle in common. The effect appeared as a function of the momentum of the common particle while the total energy was fixed. (auth)

23618

ELECTRIC-MONOPOLE-ENHANCED $2^{+\prime} \rightarrow 2^+$ TRANSITIONS IN Th^{232} AND U^{238}. F. E. Durham, D. H. Rester, and C. M. Class (Rice Univ., Houston, Tex.). Phys. Rev. Letters 5, 202-5(1960) Sept. 1.

The internal conversion spectra from Th^{232} and U^{238} bombarded with 5-Mev protons were examined for EO-enhanced transitions between $2^{+\prime}$ β-vibrational and 2^+ first-excited rotational states. For U^{238} the 991-kev transition is assigned as the EO-enhanced $2^{+\prime} \rightarrow 2^+$ cascade from the 1036-kev β-vibrational state, and for Th^{232} both the strong monopole-enhanced 725-kev and weak 738-kev transitions are assigned as $2^{+\prime} \rightarrow 2^+$ from 775-kev β- and 788-kev γ-vibrational states, respectively. The various transition probabilities are calculated for testing theories of monopole enhancement. (D.L.C.)

23619

NONLOCAL POTENTIAL AND ALPHA-DECAY BARRIER PENETRABILITY. Manujendra Lal Chaudhury (Indian School of Mines and Applied Geology, Dhanbad, India). Phys. Rev. Letters 5, 205-6(1960) Sept. 1.

The effects of the velocity-dependent character of the α-nucleus interaction on the α-decay barrier penetrability factor were studied using a nonlocal potential approximated by a Gaussian exponential. The results are slightly different from those obtained with the static potential; e.g., for Fm^{254}, the nonlocal factor is 5.848×10^{-24} as compared with the static factor 3.524×10^{-24}. (D.L.C.)

23620

CHARGED PARTICLE AND TOTAL REACTION CROSS SECTIONS FOR PROTONS AT 9.85 Mev. Verena Meyer and Norton M. Hintz (Univ. of Minnesota, Minneapolis). Phys. Rev. Letters 5, 207-9(1960) Sept. 1.

Measurements are reported for the sum of cross sections for all 9.85-Mev proton reactions in which a charged particle is emitted (p,q). The (p,q) and (p,n) cross sections are added to give total reaction cross sections σ_R, neglecting (p,γ). The targets are C, Al, Ti, V, Fe, Co, Ni, Cu^{63}, Cu^{65}, Zn^{66}, Ag, and Sn. The σ_R values calculated from a central potential by Glassgold et al. were found to be 100 to 200 mb lower than the experimental σ_R. This discrepancy is taken to be evidence for the extension of W(r) beyond V(r). (D.L.C.)

23621

INVESTIGATION OF MEDIUM AND HEAVY NUCLEI BY QUASI-FREE PROTON-PROTON SCATTERING. Gerhard Jacob and Th. A. J. Maris (Universidade do Rio Grande do Sul, Pôrto Alegre, Brazil). Phys. Rev. Letters 5, 210-11 (1960) Sept. 1.

High-energy quasi-free p-p scattering is shown to be a promising tool for investigating medium and heavy nuclei as well as light nuclei. The case of coplanar ($\alpha_0 = 0$) quasi-free scattering of 150-Mev protons is treated with reference to the two pole caps at the ends of the nuclear symmetry axis orthogonal to the scattering plane. If α_0 is a small nonzero value, the pole cap contributions remain approximately equal. If measurements are made in such a way that many different final states contribute to the cross section, the α_0-dependent interference pattern will fade out. The conditions for the applicability of the treatment to particular nuclei are given. (D.L.C.)

23622

DETERMINATION OF RELATIVISTIC NUCLEUS CHARGE BY DELTA-ELECTRON METHOD OF CALCULATIONS. A. A. Loktionov and A. Z. Semenov (Inst. of Nuclear Physics, Academy of Sciences, Kazakh SSR). Pribory i Tekh. Ekspt. No. 3, 31-3(1960) May-June. (In Russian)

Two minimum values were selected for δ-electron energies in order to determine the charge of relativistic nuclei. The suggested method would raise the accuracy of evaluation 30 %. The absolute order of error for determining the charge did not exceed half a unit in the range $3 < Z < 12$. (tr-auth)

23623

THE SCATTERING OF 28.5 Mev ^3He PARTICLES BY ^{12}C, ^{20}Ne, AND ^{40}A NUCLEI. J. Aguilar (Univ. of Valencia), W. E. Burcham, J. B. A. England, A. García, P. E. Hodgson, P. V. March, J. S. C. McKee, E. M. Mosinger, and W. T. Toner. Proc. Roy. Soc. (London), A 257, 13-21 (1960) Aug. 23.

Differential cross sections for the elastic and inelastic scattering of 28.5 Mev He^3 particles by the nuclei C^{12}, Ne^{20}, and Ar^{40} were measured by means of a photographic technique. The $C^{12}(He^3, \alpha)$ reaction was also observed. The elastic scattering distributions were analyzed in terms of an optical model. (auth)

23624

NATURAL WIDTH AND DOPPLER BROADENING IN THE ^{152}Sm 961 kev γ-RAY RESONANCE. P. B. Moon and B. S. Sood (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London), A 257, 44-51(1960) Aug. 23.

By moving a $Eu_2^{152m}O_3$ source on the tips of a high-speed rotor, the 961 kev emission spectrum was swept across the resonance line of a stationary Sm_2O_3 scatterer. The observed resonance/fluorescence intensity was compared with a curve calculated by taking into account the Doppler effects due to electron capture and thermal motions but neglecting the effects of natural line widths. At negative rotor speeds, when the emission line scans the low-energy wing of the resonance line, the influence of the natural line width on the resonance/fluorescence intensity was observed. At positive rotor speeds there is a good agreement with the theoretical calculations; this shows that with a stationary source the thermal broadening is dominant in restoring the resonance whereas the line wing overlap is negligible. (auth)

23625

LIFETIME OF THE 961 kev 1^- LEVEL IN ^{152}Sm. G. G. Shute and B. S. Sood (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London), A 257, 52-8(1960) Aug. 23.

With a $Eu_2^{152m}O_3$ source and a SM_2O_3 scatterer, nuclear γ ray resonance scattering and resonance fluorescence self-absorption experiments were performed to determine the lifetime of the 961 kev 1^- level in Sm^{152}. The value obtained from scattering, $8 \pm 2 \times 10^{-14}$ sec, is larger than that determined from self absorption, $4.7 \pm 0.5 \times 10^{-14}$ sec; this could be due to inadequate knowledge about the slowing down of the source nuclei before the emission of the γ-ray. From a comparison of these values, a mean free path of 0.6×10^{-8} cm for the source nucleus recoiling after electron capture in $Eu_2^{152}O_3$ has been calculated. (auth)

23626

THE SIGN OF THE K^--NUCLEUS POTENTIAL. P. B. Jones (Univ. of Oxford). Proc. Roy. Soc. (London), A 257, 109-14(1960) Aug. 23.

The small-angle elastic scattering of K^- mesons by the nuclei of photographic plates was measured in the energy interval 106 to 144 Mev. The experimental reaction cross section and elastic differential cross section are compared with cross sections obtained from the optical model of the nucleus by exact numerical solution of the Klein–Gordon equation at 125 Mev. If the potential radius (Woods & Saxon 1954) is $r_0 = 1.07 A^{1/3} \times 10^{-13}$ cm, the most probable value of the real part of the potential is $U = -30$ Mev. For $r_0 = 1.20 A^{1/3} \times 10^{-13}$ cm, $U = -16$ Mev. The experimental values of U appear to resolve the sign ambiguity in the real parts of the K^--nucleon s-wave scattering lengths. (auth)

23627

THE QUADRUPOLE POLARIZABILITIES AND NUCLEAR SHIELDING FACTORS OF THE HELIUM SEQUENCE. A. Dalgarno, W. D. Davison, and A. L. Stewart (Queen's Univ., Belfast). Proc. Roy. Soc. (London), A 257, 115-21 (1960) Aug. 23.

The quadrupole polarizabilities and nuclear shielding factors of the helium sequence are calculated to high accuracy by a combination of variational and perturbation methods. The results suggest that the simpler methods usually employed are satisfactory for computing polarizabilities but less so for computing shielding factors. (auth)

23628

EXCITATION OF NUCLEI BY ELECTRONS AND X-RAYS. Kuo-chu Ho (Nan-Kai Univ., China). Wu Li Hsüeh Pao 14, 289-99(1958). (Translated from Referat. Zhur. Fiz. No. 6, 1959, abstract No. 12487).

A theoretical study was made of the excitation of nuclei by electrons and photons of intermediate energy, and the cross section of nuclear excitation produced by the interaction of the electromagnetic fields of the electron and the photon with the electromagnetic dipole and the quadrupole moments of the nuclei, respectively, was calculated. These cross sections are proportional to the squares of the moduli of the matrix elements of the corresponding nuclear moments. The ratio of the cross sections for the excitation of the nuclei by the electron and the photon in all four cases depends on the change in energy, angular momentum, and parity in the considered transition. It is independent of other properties of the nucleus. The results of the theory are compared with the experimental data for In^{115}. It is shown that the accuracy of these data is insufficient to yield information on nuclear levels. Experiments that would permit obtaining such information are indicated.

23629

ON THE MECHANISM OF EMISSION OF INSTANTANEOUS FISSION NEUTRONS. V. N. Nefedov. Zhur. Eksptl'. i Teoret. Fiz. 38, 1657-62(1960) June. (In Russian)

The spectra of fission neutrons emitted at certain angles with respect to the direction of flight of the fragments (0 and 180°; 40 and 120°; 90°) were measured. The spectra of neutrons emitted by light and heavy fragments separately were compared. The kinetic energy and temperature of the light and heavy U^{235} fission fragment groups at the instant of emission of fission fragments were also determined. (auth)

23630

THE (p,d) REACTION AND INELASTIC SCATTERING OF PROTONS ON Be^9. O. F. Nemets, L. S. Saltykov, and M. V. Sokolov (Inst. of Physics, Academy of Sciences, Ukrainian, SSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1663-4 (1960) June. (In Russian)

Angular distributions of protons elastically scattered on Be^9 nuclei and also of deuterons from the Be^9 (p,d)Be^8 reaction were measured for incident proton energies of 6.8 Mev. (auth)

23631

INVESTIGATION OF HIGH ENERGY PROTONS EMITTED IN THE PHOTODISINTEGRATION OF Li^6. E. B. Bazhanov and L. A. Kul'chitskiĭ (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 38, 1685-7(1960) June. (In Russian)

Protons possessing energies of 16 Mev and above were studied. Data relating to the excitation functions, angular distributions, and n-p coincidences suggest that the probability for formation of highly excited states in the He^5 and Li^5 nuclei as a result of a single-particle reaction on the Li^6 nucleus should be quite high. (auth)

23632

NONRADIATIVE TRANSITIONS IN HEAVY μ-MESIC ATOMS. M. Ya. Balats, L. N. Kondrat'ev, L. G. Landsberg, P. I. Lebedev, Yu. V. Obukhov, and B. Pontekorvo (Pontecorvo). Zhur. Eksptl'. i Teoret. Fiz. 38, 1715-19 (1960) June. (In Russian)

The spectra of mesic x-ray photons emitted by μ-mesic atoms of uranium and lead are studied with the aid of a scintillation spectrometer. It is shown that the 2P → 1S radiative transition rate per stopped muon is appreciably smaller in mesic uranium than in lead. Thus it is experimentally demonstrated that there exists a hitherto unobserved nonradiative transition mechanism in which the transition energy is transferred directly to the nucleus. (auth)

23633

RANGE AND KINETIC ENERGY DISPERSION OF U^{233} FISSION FRAGMENTS. K. A. Petrzhak, Yu. G. Petrov, and E. A. Shlyamin (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1723-8(1960) June. (In Russian)

The range distribution of U^{233} fission fragments (Sr^{91-92}, Y^{92-93}, Zr^{97}, Ba^{140}, Ce^{143}) in various gases is studied. The dependence of the range dispersion on the nature of the gas was established. From the range dispersion the kinetic-energy dispersion due only to fission processes was determined. The results are compared with available experimental data and Fong's statistical theory. (auth)

23634

ALPHA-DEUTERON MODEL OF THE Li^6 NUCLEUS. T. I. Kopaleishvili, I. Sh. Vashakidze, V. I. Mamasakhlisov, and G. A. Chilashvili (Inst. of Physics, Academy of Sciences, Georgian, SSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1758-64 (1960) June. (In Russian)

Under the assumption that nucleons of the Li^6 nucleus predominantly form α-particle and deuteron subsystems, a calculation is carried out of the energy of relative motion of these subsystems and it is shown that the energy has a minimum in the negative value region. The energy of the 0^+, T = 1 excited state of the Li^6 nucleus is determined. (auth)

23635

POSSIBILITY OF APPLICATION OF THE (n,2n) REACTION IN NUCLEAR SPECTROSCOPY. V. V. Komarov, A. B. Kurepin, and A. M. Popova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 38, 1824-8(1960) June. (In Russian)

The (n, 2n) reaction is treated as a stripping reaction. The angular distribution of the center of mass of two neutrons simultaneously emitted as a result of direct interaction is computed. An account of the interactions between the emitted neutrons in the final state is found to be important. As an example, the angular distributions are calculated for the reactions Be^9(n, 2n)Be^8 and Pb^{208} (n, 2n)^{207} corresponding to the levels 2.9 Mev and 1.63 Mev of the final nuclei. It is shown that it should be possible to elucidate the mechanism of the reaction (n, 2n) and determine the characteristics of the nuclear energy levels by investigating the angular dependences in the spectra of neutrons emitted from targets irradiated with neutrons. (auth)

23636

EFFECT OF SUPERFLUIDITY OF HEAVY NUCLEI ON SINGLE-PARTICLE ELECTROMAGNETIC TRANSITIONS AND β-DECAY. M. G. Urin (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 38, 1852-3(1960) June. (In Russian)

Formulas are deduced for the probabilities of single-particle electromagnetic transitions and of β decay with consideration to pair correlations of the nucleons in heavy nuclei. (auth)

23637

SOME EXPERIMENTAL POSSIBILITIES FOR VERIFICATION OF THE MODEL OF MONAXIAL NUCLEI WITH A ROTATIONAL SPECTRUM. D. P. Grechukhin. Zhur. Eksptl'. i Teoret. Fiz. 38, 1891-3(1960) June. (In Russian)

It is shown that observation of E0-transitions of the $I^+ \rightarrow I^+$ type (I is the nuclear spin in even-even nuclei) is a crucial test of the model of nonaxial nuclei with a rotational spectrum. The isotopic shift predicted by the model is considered. (auth)

23638

ON THE CONNECTION BETWEEN THE β-ELECTRONS POLARIZATION AND THE FORM OF THE β-SPECTRUM. B. V. Geshkenbein and A. P. Rudik. Zhur. Ekeptl'. i Teoret. Fiz. 38, 1894-5(1960) June. (In Russian)

The correlation is established between the longitudinal polarization of the β electrons and the form of the β spectrum. (auth)

23639

DISPERSION FORMULAS FOR OVERLAPPING LEVELS. V. I. Serdobol'skiĭ (Lebedev Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 38, 1903-6(1960) June. (In Russian)

Dispersion formulas are deduced in a theory in which the S-matrix is assumed to be linear with respect to resonances. The indefinite phase shifts of the complex reduced half-widths are calculated in a general form on the basis of the S-matrix unitarity condition. Cases are considered when an isolated level corresponding to compound nuclear formation in the optical resonance region or when two levels of the compound nucleus overlap or a set of weakly overlapping levels exist in the optical resonance region. In all calculations the assumption is made that the levels of the compound nucleus do not overlap the nuclear reaction thresholds. (auth)

23640

THE INFLUENCE OF MAGNETIC FIELD ON RESONANCE X-RAY ABSORPTION. V. A. Lyubimov and A. I. Alikhanov (Inst. of Experimental and Theoretical Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1912-14(1960) June. (In Russian)

The Zeeman effect was observed in Sn^{119m} at 23.8 kev (lifetime 2.67×10^{-8} sec, lever width 2.5×10^{-8} ev). Tin heavily enriched with Sn^{118} (96%) and with Sn^{112} admixture less than 0.05% was used. The measurements were made with white tin absorption thicknesses of 36, 11, and 5 mg/cm^2. The magnitude of the Sn^{119m} magnetic excitation level was $\mu = (1.1 \pm 0.1)\ \mu.$ or $\mu = (1.72 \pm 0.06)\ \mu.$ at the Debye temperature θ of 170°K. The magnitude $\mu = (1.1 \pm 0.1)\ \mu.$ agrees with the accepted level scheme for Sn^{119m}. The calculated magnetic moment does not depend greatly on the Debye temperature; at $\theta = 200°K$, $\mu = -1.15\ \mu$ and at $\theta = 140°K$, $\mu = -1.05\ \mu.$; $\mu.$ represents the magnetic moment of the Sn^{119} ground level and equals to -1046 nuclear magnetons. (R.V.J.)

23641

LIFE-TIME OF 321 Kev LEVEL OF Hf^{177}. G. A. Vartapetyan (Inst. of Physics, Academy of Sciences, Armenian, SSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1916-17(1960) June. (In Russian)

Certain level properties of odd deformed nuclei were previously described within the frame work of Bohr-Mattelson and Nilsson models; however, the intensity rules do not agree for Hf^{177} where the E1 probability ratio of 208 and 321 kev differ from the theoretical value. An attempt is made to find the absolute magnitudes of transition probability values for γ radiation with hv = 208 and 321 kev. The life-time of 321 and 208 kev levels were measured by the method of retarded coincidences and were found to be $P_{\gamma 321}(E1) = 5.5 \times 10^{7}\ sec^{-1}$ and $P_{\gamma 208}(E1) = 1.4 \times 10^{9}\ sec^{-1}$. The E1 transition forbiddeness is compared to the 396 and 282 kev E1 transitions in Lu^{175} kev transition in Lu^{177}. If it is postulated that the above transitions are described by the collective model, the 208 kev transition is considerably accelerated (about 800 times) in comparison to the transition between singlet 321 kev level and the pure rotational level 113 kev. In contrast if it is assumed that the 208 kev transition agrees with the simple collective model and Nilsson's formula ($f_{H^{208}} = 0.6$), the E1 transition for 396(Lu^{175}), 321(Hf^{177}), and 147 kev (Lu^{177}) is slowed down by secondary effects. (R.V.J.)

23642

METHODS OF NUCLEAR ORIENTATION. E. Ambler (National Bureau of Standards, Washington, D. C.). p.233-80 of "Progress in Cryogenics. Volume 2." K. Mendelssohn, ed. New York, Academic Press Inc., 1960.

The successful development of methods of orienting nuclei is based upon progress made in understanding the hyperfine coupling in paramagnetic salts. A summary is given of the relevant experiments and the orientation methods used. Some of the experiments are described to illustrate the potentialities of the methods. The areas where nuclear orientation methods have provided a basis for interesting and useful experiments in the field of nuclear physics are pointed out. The various methods for orienting nuclei are outlined and the criteria, applicability, and special requirements are given. (B.O.G.)

23643

HIGH ENERGY NUCLEAR PHYSICS. W. O. Lock. Methuen's Monographs on Physical Subjects. New York, John Wiley & Sons, Inc., 1960. 198p. $3.25.

The included information is based on lectures given at Birmingham University for first year postgraduate students in nuclear physics. It includes an explanation of the concepts and principles and is intended to be an introduction to the subject. The important topics of high-energy electron scattering and of strange particles were excluded, partly to keep the book from being too large and partly because comprehensive review articles on both these subjects have recently appeared. The topics discussed are pion scattering by nucleons, photoproduction of pions, pion production by nucleons, and nucleon-nucleon and nucleon-complex nucleus interactions at energies above 100 Mev. (B.O.G.)

23644

NEUBESTIMMUNG DER HALBWERTSZEIT DES Rb^{87}. (New Determination of Half-life of Rb^{87}). Wilfried Rausch. Thesis, Marburg/Lahn, Ger., Philipps Universität, 1960.

The half life of Rb^{87}, which is important in geological dating, was determined in a Houtermans and Oeschger anticoincidence counting tube that was shielded by 10 cm of iron and 5 cm of lead. A background rate of 2 counts/min was measured. A 1:1 mixture of argon and CH_4 was used at 400 torr. Measurements with UV established the β sensitivity of the apparatus at 100% at 2 kev, 95% at 1 kev, and 50% at 80 ev. The value obtained was $(4.72 \pm 0.08) \times 10^{10}$ years. (T.R.H.)

Particle Accelerators

23645 DESY-A2.61

Deutsches Elektronen-Synchrotron, Hamburg.

ZUR MESSUNG DER STRAHLANPASSUNG. (Measurement of Radiation Adaptation). U. Timm. Apr. 14, 1960. 9p.

Operating experience with the CERN proton synchrotron shows how important it is that the linac emittance be adjusted to the acceptance of the synchrotron and that the adjustment be controllable. The application of this principle to the DESY is discussed. (T.R.H.)

23646 NP-8894

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

POWER INPUT COMPUTATION FOR PROTON LINEAR

ACCELERATOR. (Obliczenie Mocy Wielkiej Czestotliwości Dla Protonowego Akceleratora Liniowego). Report No. 143/VII. S. Kuliński. Mar. 1960. 19p.

The theoretical approximate method for computation of the power input for a proton linear accelerator, necessary to excite the desired value of amplitude of accelerating field, is given. The numerical results are close to those obtained experimentally by the group of Alvarez. (auth)

23647 | NP-8899
Illinois. Univ., Urbana.
BEAM ANALYZER MAGNET PART I. Technical Report No. 17. Van Bluemel and Santimay Chatterjee. May 11, 1960. 48p. Contract Nonr 1834(05).

The design and operations of the magnet used to analyze the energy of the particles accelerated by the spiral ridge cyclotron of the University of Illinois are described. The old 16 in. diam. cyclotron magnet is converted to a 30° sector magnet by adding two wedge-shaped pole pieces. Data are given on field measurements. The control circuit used for regulating the current in the magnet is described. (W.D.M.)

23648 UCRL-9124
California. Univ., Berkeley. Lawrence Radiation Lab.
A STUDY OF SOME COHERENT ELECTROMAGNETIC EFFECTS IN HIGH-CURRENT PARTICLE ACCELERATORS (thesis). Verl Kelvin Neil. Apr. 26, 1960. 138p. Contract W-7405-eng-48. OTS.

Two coherent effects by which particles circulating in an accelerator may lose energy are considered. The vacuum tank is assumed to be a toroid with rectangular cross section, highly conducting walls, a major radius very much larger than its cross sectional dimensions, and no discontinuities or windows. The beam configuration is assumed to be given and to be unaffected by the energy losses. The beam is assumed to have a negligible cross-sectional area. Expressions for the electromagnetic fields arising from the given current and charge distribution are presented in three different forms. The first loss mechanism considered is the dragging of image charges through the walls of finite conductivity. This is found to be a small effect for circulating currents of the order of 1 amp. A proof is developed that in such a vacuum tank there exist eigenmodes with phase velocities in the azimuthal direction that are less than the velocity of light. It is then possible for a relativistic beam to be in resonance with such a mode. It is shown that the excitation of these modes leads to a negligible energy loss in the types of vacuum chambers considered. The interaction of the beam with a radiofrequency cavity that provides the accelerating mechanism of the machine is discussed. The passage of the beam induces a back voltage on the cavity. The total voltage is the sum of the back voltage and the externally applied voltage. A Hamiltonian for synchrotron motion is employed that makes possible the simultaneous solution of Maxwell's equations and the Vlasov equation, so that a self-consistent distribution of particles in synchrotron phase space is determined. The induced voltage is of the order of magnitude of the product of the total circulating current in the accelerator and the shunt impedance of the rf cavity. It has the net effect of reducing the total cavity voltage and shifting its phase relative to the applied voltage. The stable phase angle must then be increased for the particles to remain in phase with the accelerating radio frequency. The decrease in total voltage and increase in stable phase angle result in a decrease in stable phase space available for acceleration. It is shown that the consequences of the induced voltage may be alleviated by increasing the voltage applied to the cavity. (auth)

23649
ATTRACTIVE PROSPECTS AND DISQUIETING UNKNOWNS IN THE PHYSICS OF LARGE ACCELERATORS. G. Bernardini (Università, Rome). Nuovo cimento (10) 16, Suppl. No. 1, 9-16(1960). (In Italian)

A brief survey is made of the scientific studies possible with high-energy accelerators. The basic research being conducted at present is reviewed. The responsibilities of science to civilization are indicated. (J.S.R.)

23650
THE MAGNETIC DEFLECTOR OF THE BUENOS AIRES 180-cm SYNCHROCYCLOTRON BEAM. J. Rosenblatt and R. J. Slobodrian (Comisión Nacional de Energie Atómica, Buenos Aires). Rev. Sci. Instr. 31, 863-8(1960) Aug.

The magnetic deflector system of the Buenos Aires 180-cm synchrocyclotron beam consists of a regenerator and a critical magnetic channel. The channel was built starting on the maximum of the radial oscillation and following a trajectory given by $\rho = 83.5 + 10\alpha^{3/4}$ (in cm), when (ρ,α) are polar coordinates with origins at the center of the machine and α is measured from the maximum of the radial oscillation. Alternating gradient magnetic fields were used in order to keep the beam parallel up to the magnetic quadrupoles. Thus the vertical divergence of the beam was vanishingly small and the radial divergence was 1/200. With the complete assembly in place, 20% of the circulating beam was thrown by the regenerator into the magnetic channel, and its transmission was 10%. The over-all extraction efficiency was 2%. (auth)

Plasma Physics and Thermonuclear Processes

23651 JPL-TR-32-4
Michigan. Univ., Ann Arbor.
NOTES ON PLASMA PHYSICS. Richard K. Osborn. Apr. 1, 1960. 113p. Contract NASw-6.

Issued by California Inst. of Tech., Pasadena. Jet Propulsion Lab.

A limited summary is presented of some aspects of plasma physics. The presentation is intended to be as fundamental as is reasonably feasible with particular emphasis on certain areas of the subject matter in which logical deduction must, at the present stage of development, give way to intuitive argument. Consequently, primary attention is focused upon two particular areas of the subject matter: the basic task of developing a mathematical description of the plasma; and, given a description, the attempt to deduce consistent predictions about expected behavior of plasmas when subjected to small perturbations in the simplest physical context—that of the infinite, homogeneous medium. (auth)

23652 MATT-1(2nd Ed.)
Princeton Univ., N. J. Project Matterhorn.
CUMULATIVE LISTING OF PROJECT MATTERHORN REPORTS AND PUBLICATIONS. July 1, 1960. 19p. Contract AT(30-1)-1238. OTS.

A compilation of all Matterhorn project reports through June 30, 1960, is presented. The Matterhorn and NYO numbers are listed before each title. (J.R.D.)

23653 MIT-NSL-TN-434
Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.
ON THE THERMODYNAMICS OF A MAGNETIZED AND UN-MAGNETIZED PLASMA. Eugene E. Covert. Dec. 1949. 18p.

Talk presented at Plasma Physics Seminar Sponsored by the Massachusetts Inst. of Tech., Industrial Liaison Office, on December 17, 1959.

Studies on the thermodynamics of an unmagnetized plasma indicated that the Debye-Huckel theory can be applied to a plasma over a wide range of pressures and temperatures with errors of less than 3%. The correction to the thermodynamics of a perfect gas due to charge association was generally less than 15% and at pressures of one atmosphere or less it was below 1%. Studies on a magnetized plasma made up of particles with permanent magnetic dipole moments revealed the same thermal entropic and caloric state equations as an unmagnetized plasma. (C.J.G.)

23654 RISÖ-15
Denmark. Atomenergikommissionen. Forsögsinstitut, Risö.
ON THE SELF-HEATING OF A PLASMA BY THERMONUCLEAR REACTIONS. O. Kofoed-Hansen. May 1960. 18p.

The self-heating of a plasma by thermonuclear reactions is considered in some detail under the assumption of constant electron density and in the temperature region $4 \text{ kev} < kT < 20 \text{ kev}$ where simple approximations yield good solutions to the reaction kinetics. It is concluded that less than approximately 3% T enrichment is unlikely to yield a match-head effect for the D. The slowing down of the charged reaction products and the energy exchange between electrons and ions is considered instantaneous in these calculations. (auth)

23655 WADD-TR-60-432
Borg-Warner Corp. [Research Center], Des Plaines, Ill.
PULSED PLASMA PROPULSION—AN ADVANCED REACTION SPACE PROPULSION SYSTEM. Final Report covering Period: July 1, 1959 to June 30, 1960. Thomas L. Thourson and Robert G. Schroeder. June 1960. 74p. Contract AF33(616)-6036.

Analog computer solutions to equations describing plasma acceleration by a rail-type accelerator are discussed. The open rail accelerator showed a decided increase in thrust per unit power (T/P) as the stored energy increased while the loop accelerator showed very little increase. The average values of T/P for energy storage capacitances of 5, 10, and 15 μf were roughly equal for the two accelerators. The kinetic energy, impulse, efficiency, velocity, mass per pulse, and thrust per unit power were determined as functions of stored energy and rail length for the rail accelerator. The 10 cm rail accelerator was found to be slightly more efficient than the others. The capabilities of pulsed plasma systems to performing space missions were analyzed. Calculations of thrust and jet power, propellant mass flow rate, and payload as a function of initial vehicle mass were made for 200, 500, 1000, 2000, 5000, 10,000, and 22,300 mile orbital transfer missions. The propulsion system mass (power supply and propellant) required to sustain a 6-ft-diam. vehicle at 100 mile orbit for 0.5 to 5 years was calculated. The reasons for low efficiencies in the two accelerator systems are discussed. It is concluded that these systems can compete successfully with other systems only if long mission duration is a factor. (See also WADC-TR-59-321.) (C.J.G.)

23656 JPRS-5277
MAGNETOHYDRODYNAMIC GAS-IONIZING SHOCK WAVES. A. G. Kulikovskii (Kulikovskiy) and G. A. Lubimov (Lyubimov). Translated from Doklady Akad. Nauk S.S.S.R. 129, 52-5(1959). 11p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 3882.

23657
SOME PROBLEMS REGARDING THE PHENOMENA OCCURRING AT THE CATHODE OF THE GLOW DISCHARGE. Eugen Badareu and Iovitzu Popescu. Acad. rép. populaire Roumaine, Rev. phys. 5, 41-82(1960). (In English)

The results of studies on the mechanism of the phenomena occurring at the discharge cathode in glow discharge were presented. The kinetics of the positive ions were first considered with a discussion of the drift velocity of the ions, a study of positive ion kinetics by reverse field method, and a computation of resonant charge transfer cross section. The general features of the mechanism of the phenomena at the simple and at the double cathode of the abnormal glow discharge were determined. The electric field in the dark space and localization of the ionizations in the cathodic parts were examined theoretically. Then experimental results on the mechanism at the simple and double cathode were analyzed. 120 references. (J.S.R.)

23658
JETS OF A PERFECTLY CONDUCTING INVISCID GAS IN THE PRESENCE OF A MAGNETIC FIELD PARALLEL TO THE STREAM. Shigeki Morioka (Kyoto Univ.). J. Phys. Soc. Japan 15, 1516-22(1960) Aug. (In English)

The two-dimensional and the axially symmetrical jets of a perfectly conducting inviscid gas in the presence of a magnetic field parallel to the stream are investigated on the basis of the linearized theory when the jets are governed by the supersonic hyperbolic equation. To this approximation, the fundamental equations and the boundary conditions are found to agree in their forms with those in the ordinary gasdynamic case, except for some parameters. Therefore, it is possible to obtain the solutions at once by making suitable substitution of the parameters in the well-known solutions for the gasdynamic case. However, when the surrounding flow is governed by the subsonic hyperbolic equation, the circumstance is somewhat different from the gasdynamic case because disturbances in the surrounding flow propagate along the upstream characteristics. The structure of such a jet in the two-dimensional case is re-examined from the view point of reflection and refraction of a weak plane shock wave incident upon an interface between two streams. (auth)

23659
A NEW PLASMA CONFINEMENT GEOMETRY. James L. Tuck (Los Alamos Scientific Lab., N. Mex.). Nature 187, 863-4(1960) Sept. 3.

The picket fence or cusped geometry method of plasma confinement is discussed with reference to a new geometry based on the helix and called the helixion, which makes possible stable $\beta = 8\pi kT/B^2 = 1$ confinement with zero cusp losses in a torus. The problem of maintaining hydromagnetic stability in the bridge between the cusps on either side of the helixion wire is treated. The helixion idea is extended to an open-ended helixion. It is stated that as the inclination of the wire to the magnetic field is reduced, the cusped region shrinks and vanishes without touching the wire. The advantages of an open-ended helixion are that it is easier to cool the helix and to operate it on the d-c. The magnetic lines also can be terminated at the ends, thereby making it possible to divert the quiescent plasma diffusion to the walls. (D.L.C.)

23660
PLASMA RESEARCH DONE BY THE LABORATORIO GAS IONIZZATI DEL C.N.R.N. B. Brunelli (Comitato Nazionale

per le Ricerche Nucleari, Rome). Nuovo cimento (10) 16, Suppl. No. 1, 76-81(1960). (In Italian)

The four experimental studies undertaken by the Laboratorio Gas Ionizzati since its construction in 1958 are briefly described. The studies were the formation of the plasma sheath in a magnetic field, optical measurements of the density of electrons, and two studies on the effect of perpendicular compression. (J.S.R.)

23661

BOLTZMANN-VLASOV EQUATION FOR A QUANTUM PLASMA. Oldwig von Roos (California Inst. of Tech., Pasadena). Phys. Rev. 119, 1174-9(1960) Aug. 15.

A new equation was derived which is a quantum mechanical analog of the classical collisionless Boltzmann equation. A new quantum mechanical distribution function was employed which was particularly useful in this case. Quantum corrections for longitudinal plasma oscillations were evaluated for a low-density plasma, and it was found that the leading contribution $(\sim\hbar^2)$ was due to exchange (Pauli principle). (auth)

23662

PLASMA PHYSICS ("QUANTUM" AND "CLASSICAL"). Marshall N. Rosenbluth (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Today 13, No. 8, 27-30(1960) Aug.

A qualitative description was given of the similarities and contrasts between "classical" and "quantum" plasma physics. The basic similarity is that both cases are concerned with particles which interact through electric and magnetic forces. Quantum plasmas are primarily studied in connection with solid-state physics while classical plasma studies are motivated by fusion-reactor work, electron-tube research, and astrophysical applications. The study of quantum plasmas is concerned with the properties of a true thermodynamic equilibrium and with small excitations around such an equilibrium. The true thermodynamic equilibrium of a classical plasma is a Maxwellian distribution uniformly filling all space; thus it is basically a nonequilibrium problem. The present state of the development of the theory of classical plasmas was described. The derivation of dispersion relations in an infinite homogeneous plasma was discussed. (B.O.G.)

23663

ON THE DAMPING OF MAGENTO-HYDRODYNAMIC WAVES IN A RAREFIELD PLASMA. V. V. Dolgopolov and K. N. Stepanov. Ukraĭn. Fiz. Zhur. 5, 59-64(1960) Jan.-Feb. (In Ukrainian)

The damping of magnetohydrodynamic waves, propagated in a rarefield plasma, owing to "near" collisions was considered. A dispersion equation was derived and investigated for magnetohydrodynamic waves propagated along and across the magnetic field. It was shown that a calculation based on a precise allowance made for "near" collisions within the confines of kinetic theory yielded results which differed substantially from those obtained in the approximation of the theory of a two-component fluid. (auth)

23664

THE "EFFECTIVE" IONIZATION ENERGY OF THE ATOMS OF A PLASMA AND THE CONTRIBUTION OF THE HIGHEST ATOMIC TERM TO CONTINUOUS EMISSION. Julius Brunner (Technische Hochschule, Munich). Z. Physik 159, 288-310(1960). (In German)

The ionization energy of the atoms of a plasma was introduced as a statistical magnitude dependent on the microfield under consideration, and the number of ionized atoms was given for infinitesimal intervals of the ionization energy (generalized Saha equation). For hydrogen-like atoms the continuous emission which occurs by the transition between the strongly perturbed high atomic terms was calculated. The emission coefficient for the total continuous radiation arising from electron transition in the ionic field was given for a plasma from hydrogen-like atoms. The "effective" ionization energy for this radiation was determined and estimated for a special plasma. (tr-auth)

23665

SKIN-EFFECT AND SHOCK WAVES IN AN INDUCTION GAS DISCHARGE. S. E. Grebenshchikov and M. D. Raizer. Zhur. Ekspt'. i Teoret. Fiz. 38, 1665-7(1960) June. (In Russian)

A gas discharge induced at a frequency of 300 kc was investigated. Under the conditions of the experiment, the shock wave front was found to break away from the current layer. The current distribution in the discharge chamber was determined by the nature of the skin effect for metallic conductors. (auth)

23666

KINETIC EQUATION FOR RAPIDLY VARYING PROCESSES. V. P. Silin (Lebedev Inst. of Physics, Moscow). Zhur. Ekspt'. i Teoret. Fiz. 38, 1771-7(1960) June. (In Russian)

A kinetic equation is considered for processes characterized by times which are small or comparable to the collision times. In the most interesting case of a charged particle gas in the absence of a magnetic field and for frequencies which greatly exceed the Langmuir frequency ω_0, it is found that not the Debye screening range but the distance traversed by the particle during the field period appears as the maximal impact parameter in the Coulomb logarithm. The effective frequency of collisions between electrons and ions which determines the dissipative part of the complex dielectric susceptibility tensor for a plasma located in a strong constant magnetic field is computed for the same case of high frequencies. If the electron Larmor frequency is much greater than the Langmuir frequency, the maximal impact parameter in the Coulomb logarithm is found to depend in a resonance manner on the frequency of the variable field. (auth)

23667

APPLICATION OF QUANTUM FIELD THEORY METHODS FOR INVESTIGATION OF THE THERMODYNAMICAL PROPERTIES OF AN ELECTRON AND PHOTON GAS. I. A. Akhiezer and S. V. Peletminskiĭ (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Ekspt'. i Teoret. Fiz. 38, 1829-39(1960) June. (In Russian)

The thermodynamic potential of an electron, positron, and photon gas is determined by field theory methods with consideration to the interaction between the particles to an accuracy of terms proportional to $e^4 \ln e^2$. Divergences which appear in the high momentum region of the virtual particles are removed by renormalizing the electron charge and mass and by redetermination of the vacuum level. General expressions are derived which take into account relativistic effects, and asymptotic formulas are derived for the exchange and correlational energies. Corrections to the black body radiation energy due to interaction between the photons and electron-positron are obtained. (auth)

23668

INSTABILITY OF A PLASMA WITH AN ANISOTROPIC DISTRIBUTION OF ION AND ELECTRON VELOCITIES. A. B. Kitsenko and K. N. Stepanov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian, SSR). Zhur. Ekspt'. i Teoret. Fiz. 38, 1840-6(1960) June. (In Russian)

A study was made of the propagation of magnetohydrodynamic waves in an infinite rarefied plasma with an anisotropic distribution of charged particle velocities. Conditions under which instability appeared as a result of anisotropy of the distribution function were derived. It is shown that the kinetic treatment leads to an increase of the instability region compared to that obtained in the quasihydrodynamic approximation. (auth)

23669
THERMODYNAMIC FUNCTIONS OF A LOW TEMPERATURE PLASMA. A. I. Larkin. Zhur. Eksptl'. i Teoret. Fiz. 38, 1896-8(1960) June. (In Russian)

Thermodynamic functions of a plasma at temperatures below the ionization temperature are calculated. It is shown that a correct account of the interaction between the ions and electrons of the continuous spectrum partially compensates for the contribution from the excited states of the atoms and complex ions. (auth)

23670
RECENT DEVELOPMENTS IN CONTROLLED THERMONUCLEAR FUSION RESEARCH AT THE UNIVERSITY OF CALIFORNIA. C. M. Van Atta (Univ. of California, Berkeley and Livermore). p.9-44 of "Recent Research on Controlled Thermonuclear Fusion." (In English)

Controlled fusion research carried on since 1952 at the UCRL, Berkeley and Livermore, Calif., was described. Discussions of the elements of magnetic mirror confinement were presented together with a discussion of compression heating of a plasma and various schemes for injection into the magnetic mirror field. The ingenious idea of the Astron to modify the vacuum magnetic field by a very intense circulating current of highly relativistic electrons and thereby to produce the closed lines of force desired for confining a hot plasma was described. Developments starting with the simple dynamic pinch and progressing through the magnetically stabilized pinch to the Levitron were discussed, as well as other impulsive configurations for plasma heating and confinement such as the tubular pinch and the Homopolar rotating plasma device. Some of the basic plasma physics experiments in progress were mentioned. In each instance plans for future developments were indicated, and an assessment of the significance of the programme was offered. (auth)

23671
CONTROLLED THERMONUCLEAR RESEARCH AT PRINCETON UNIVERSITY. Robert G. Mills (Princeton Univ., N. J.). p.45-64 of "Recent Research on Controlled Thermonuclear Fusion." (In English)

A review was given of the origin and growth of Project Matterhorn (Princeton University's research establishment for controlled fusion studies at the James Forrestal Research Center, Princeton, New Jersey). An elementary discussion was given of the results of theoretical and experimental studies with a description of current problems. A bibliography of publications from this laboratory was presented as a guide for a thorough study of the topic. (auth)

23672
PLASMA ACCUMULATION BY HIGH-ENERGY INJECTION: THE DCX EXPERIMENT. Arthur H. Snell (Oak Ridge National Lab., Tenn.). p.65-80 of "Recent Research on Controlled Thermonuclear Fusion." (In English)

Current observations and accomplishments of the DCX experiment at ORNL were described. In this experiment, the establishment of a plasma of high-energy protons is being sought by injection of 600-kev H_2^+ ions into a magnetic mirror arrangement, with dissociation taking place therein through the agency of a carbon arc. To date, 10^{13} particles are trapped on a steady-state basis in a circulating beam, with the particle density being about 2×10^9 protons per cm^3. Charge-exchange dominates as a loss mechanism to such an extent that no other loss mechanisms are seen. Various behavior characteristics of the trapped proton population were described. (auth)

23673
International Atomic Energy Agency, Vienna.
RECENT RESEARCH ON CONTROLLED THERMONUCLEAR FUSION. Review Series. Developments in the Peaceful Applications of Nuclear Energy, No. 4. 1960. 80p. $1.00.

Three review articles are given concerning recent developments in controlled thermonuclear fusion research. The individual reviews of the "Review Series" are published in English, French, Russian, or Spanish; a summary is given in all four languages. Separate abstracts were prepared for the three articles. (B.O.G.)

23674
IMPROVEMENTS IN OR RELATING TO GAS DISCHARGE APPARATUS. Peter Clive Thonemann (to United Kingdom Atomic Energy Authority). British Patent 843,963. Aug. 10, 1960.

Gas discharge apparatus of the type in which a pulsed ring discharge is induced in a gas in a torus with a thick electrically conducting wall (cf. Patent No. 32811/56) is modified in such a way that eddy currents in the inner wall are reduced and the equilibrium axis of the current channel is placed closer to the continuous axis of the torus rather than to the outer wall. This modification is brought about by increasing the electric resistance of the inner wall; this may be done either by slotting the inner wall and filling the slots with insulating material or forming the wall out of high-resistance material. (D.L.C.)

23675
THERMONUCLEAR REACTOR. (to United States Atomic Energy Commission). British Patent 844,291. Aug. 10, 1960.

The stellarator with diverter is modified in order to eliminate electric fields and hydromagnetic instability; the modification consists of applying a multipolar magnetic field to the tube transverse to its axis. The multipolar field has its magnetic axes at or near the tube walls and vanishes at the axis of the confining field. The function of the multipolar field is to produce a rotational transform with the transform angle varying steeply with the distance of the individual lines of force from the magnetic axis, and thus to reduce the tendency of the outer and inner lines of force to interchange positions. The multipolar field may be produced by a plurality of closed coils or permanent magnet pairs extending helically along the tube. The pitch of the helical field is 5 to 20 times the tube diameter, and its strength at the tube walls is $^1/_{10}$ to $^1/_6$ that of the confining field. (D.L.C.)

Shielding

23676 NDA-2056-10
Nuclear Development Corp. of America, White Plains, N. Y.
GAMMA RAY PENETRATION IN COMPOSITE SLABS. M. H. Kalos. Mar. 15, 1957. Decl. June 10, 1960. 56p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Subcontract AT-29. OTS.

Monte Carlo calculations were made to determine the penetrations of γ rays through composite slabs of matter. In the first series of calculations the build-up at normal incidence through three mean free paths of one material followed by varying amounts of another was determined. The results were compared with single-layer results. For lead and water combinations, rough prescriptions are given for the synthesis of double-layer results from the well-known single-layer build-up factors. In addition, calculations of the slant penetration of γ rays through composite slabs of polyethylene and lead were carried out and the results compared with those in the Reactor Handbook. The new results are in fair agreement with the old. The results were also compared, in part, with normal incidence results to determine the role of "short-circuiting" of γ rays. It is concluded that within the range of this study the latter is not important for angles of incidence less than about 60°. (auth)

Theoretical Physics

23677

A PARAXIAL FORMULATION OF THE EQUATIONS FOR SPACE-CHARGE FLOW IN A MAGNETIC FIELD. P. T. Kirstein (Stanford Univ., Calif.). J. Electronics and Control (1) 8, 207-25(1960) Mar.

The equations for irrotational, axially symmetric, laminar space-charge flow are set up in a paraxial manner. For this approximation, the flow is specified by the magnetic field configuration, one trajectory, the potential along this trajectory, and the variation of beam thickness. Any three of these quantities may, within certain limits, be specified arbitrarily, and the fourth then computed by the formulas given. The method is directly applicable to flows in which the cathode is conical, and either the flow lines do not cut magnetic flux lines or the magnetic field is tangential at the cathode. Numerical results are given for a beam from a cylindrical cathode, and extensions of the methods are discussed. (auth)

23678

QUESTIONS REGARDING THE FUNDAMENTALS OF FIELD THEORY. E. R. Caianiello (Università, Naples). Nuovo cimento (10) 16, Suppl. No. 1, 61-6(1960). (In Italian)

The motivations, results, and prospects of some new research on the theory of quantized fields are reported concisely and without recourse to formula development. The calculation of the elements of the S matrix, a rigorous mathematical formulation of the renormalization of the ultraviolet divergence, and a redefinition of the integral idea are the problems discussed. (J.S.R.)

23679

EXPERIMENTAL PLASMA FLOW INTO A VACUUM MAGNETIC CUSP FIELD. F. R. Scott and R. F. Wenzel (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 119, 1187-8(1960) Aug. 15.

A directed dense plasma was observed to penetrate and be detained by a vacuum cusp magnetic field. A gross measurement of the directed velocity of the deuterium plasma was $(8.5 \pm 0.5) \times 10^6$ cm/sec. Ion density in the central region of the cusp was measured to be 8.5×10^{15} at 16 μsec after injection, and it had a decay constant of 13.5 μsec. Magnetic probe measurements were shown which indicated the gross reaction of the magnetic field to the injected plasma. Observation of impurity emission indicated that the plasma electrons cool rapidly and that the collision-dominated plasma is in contact with the container walls at the cusp ring. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

23680 AD-236713

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. NUCLEAR REACTOR SIMULATOR (thesis). Daren Lane Lucke. Mar. 1960. 58p.

The simulator is an electronic device used in conjunction with an analog computer that solves the differential equations used to describe a reactor system. The simulator has the ability to operate with any desired value for each of the reactor parameters. The simulator can be operated with either a positive, negative, or zero temperature coefficient of reactivity. The period, log n, and xenon poisoning is also included in the simulator. The control panel used for the simulator is similar to that found in actual reactors. A method of setting various reactor parameters and operating procedures for the simulator are included. (auth)

23681 APDA-139

Atomic Power Development Associates, Inc., Detroit. THE DOPPLER EFFECT IN FAST NEUTRON REACTORS (thesis). Richard Benjamin Nicholson. June 1960. 145p. OTS.

Submitted to Cornell Univ.

A new analysis of the Doppler effect in fast neutron reactors is made. The effect is evaluated for U^{235} and U^{238} at several neutron energies between 1 and 200 kev. A new method is presented for U^{238} at neutron energies below 30 kev where the previous method is shown to be invalid. The new method is based on the assumption that the individual resonances are isolated and do not overlap. The importance of inelastic scattering is evaluated and the effects of other neglects previously made without complete justification are studied in some detail. The newer data on low energy resonance parameters and high energy cross sections are examined to determine the best choice for the statistical distributions of neutron and fission widths and the distribution of resonance spacing. A crude numerical calculation for the Doppler temperature coefficient of reactivity in the Fermi Fast Breeder Reactor gives about -2×10^{-6}/C at 550°C. The results indicate that the Doppler effect from U^{235} can almost always be neglected as small but in some of the larger reactors such as a large fast oxide breeder U^{238} may contribute a negative Doppler effect of the order -10^{-5} which would be of considerable importance, especially with respect to reactor safety. (auth)

23682 CF-60-7-96

Oak Ridge National Lab., Tenn.
REACTOR PHYSICS CALCULATIONS FOR THE MSRE. C. W. Nestor, Jr. July 26, 1960. 14p. OTS.

A compilation is presented of results obtained to date from a number of reactor physics calculations for the molten salt reactor experiment (MSRE). Included are one-dimensional multigroup and two-dimensional two-group calculations of critical mass, flux, and power density distributions; gamma heating in the core can, reactor vessel, and core support grid; drain tank criticality; and an estimate of the β, γ, and delayed neutron dose rates due to fission products in the fuel contained in the pump bowl. For a cylindrical core 54 in. in diameter and 66 in. high, graphite-moderated with 8 vol % fuel salt, the calculated critical loading is 0.76 mole % uranium (93.3% U^{235}), which is equivalent to a critical mass of 16 kg. At a reactor power of 10 mw, the peak power density in the core assuming a homogeneous mixture of fuel salt and graphite is 10 watts/cm^3, the average power density is 4 watts/cm^3. The computed peak thermal flux is 7.3 × 10^{13} neutrons/cm^2 sec and the average is 2.5 × 10^{13} neutrons/cm^2 sec. Gamma heating produces a power density of 0.2 watts/cm^3 in the core wall at the midplane and 0.4 watts/cm^3 in the support grid at the bottom of the core at the reactor center line. (auth)

23683 CRIO-874
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE RELEASE OF RADIOLYTIC GASES IN THE NRX REACTOR. J. A. Morrison. Sept. 1959. Reprinted May 30, 1960. 42p. (AECL-1028). AECL.

The release of deuterium and oxygen from the heavy water in the NRX reactor was observed under different operating conditions. The rate of release, expressed as the decomposition of water in gm D_2O per Mwh, changed significantly under different operating conditions and equipment arrangements. With the present operating conditions and equipment the decomposition rate varied between 0.1 and 0.2 gm D_2O/Mwh. Other operating experiences associated with the release of deuterium and oxygen are discussed. (auth)

23684 CRRP-942
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
VOID COEFFICIENT MEASUREMENTS IN ZEEP. R. E. Green, G. A. Beer, and D. W. Hone. June 1960. 45p. (AECL-1053). AECL.

Measurements were made in ZEEP to determine the reactivity effect of a loss of coolant in 7- and 19-element UO_2 cluster lattices. The effects of expelling the coolant (a) from a single cluster at various positions in the lattice, (b) from various groups of clusters including all 55, and (c) partially from all clusters at the same time were measured for a hexagonal lattice of 7-element UO_2 clusters having a pitch of 24.56 cm. The effect of varying the D_2O purity was studied in this lattice. For the 19-element UO_2 lattices, single cluster experiments only were done for a range of lattice pitches. It was found that the experimental results could be satisfactorily explained, except in the region of core-reflector boundaries, by using a bare pile perturbation treatment which takes into account the anisotropy in the diffusion constant when the coolant is removed. (auth)

23685 DEG-Report-149
United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England.
A METHOD OF ANALYSING TRANSIENTS IN THE FLUX DISTRIBUTION IN A THERMAL REACTOR. R. I. Vaughan. Feb. 19, 1960. 20p. BIS.

Total differential equations are derived for the time behavior of neutron flux, temperatures, and Xe^{135} concentrations and for the transients in power and temperature distributions in thermal reactors. The axial flux distribution is assumed to remain constant in shape, and only the one-energy-group diffusion equation is used in the analysis. The equations can be solved on an analog computer. (D.L.C.)

23686 HKF-116(Rev.)
Ferguson (H.K.) Co. Atomic Energy Div., New York.
QUARTERLY REPORT FOR OCTOBER 1 TO DECEMBER 31, 1951. Decl. Mar. 8, 1960. 50p. Contract AT (30-1)-1075. OTS.

Progress was made on a specific reactor complex for production of plutonium. The objective of this program is a set of specifications which will serve as the basis for a cost estimate. Neutron economy, lattice characteristics, fuel replacement schedules, and production estimates were given intensive study by the theoretical group, which also guided and interpreted the early exponential experiments. Basic studies in transport theory and in pile neutron energy distribution, both of which have important effects on light water lattice properties, were continued. Process work covered detailed study of heat transfer in the reactor, including hot spots and use of finned jackets. Since the cooling system represents the bulk of the plant cost, a thorough study of alternate equipment is in progress. Detailed designs were made of reactor components, loading and unloading equipment, leak detection systems, and the primary cooling loop. The reactor building was altered to allow smoother flow of fresh and spent fuel rod bundles, and the details of rod fabrication and handling have been worked out. (auth)

23687 HW-63789
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
STUDY REPORT. HIGH SPEED DATA ACQUISITION SYSTEM FOR PRTR. R. G. Clark. Jan. 20, 1960. 7p. Contract AT(45-1)-1350. OTS.

A description, expected results, and expected performance of a 300-point data-handling and computer control system proposed for installation on the Plutonium Recycle Test Reactor are given. (C.J.G.)

23688 IDO-16606
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
SPERT PROJECT QUARTERLY TECHNICAL REPORT [FOR] JULY, AUGUST, SEPTEMBER 1959. A. H. Spano, ed. July 11, 1960. 60p. Contract AT(10-1)-205. OTS.

A core loading accident in a water moderated research reactor was simulated in Spert I by releasing a fuel assembly and allowing it to fall freely into a vacant grid position in the slightly sub-critical core. A series of transients of increasing severity was performed to determine the extent of the reactor response in such an accident and the radiation dosages that would be received by personnel situated at varying distances from the reactor. The measured reactivity wave shape generated by the Spert I oscillator fit a sine curve closely, with a second harmonic component of less than 2% and with a third harmonic component of less than 3%. Measurements were also made to determine the magnitude of the reactivity effect as a function of the axial displacement of the Cd curtain surrounding the oscillator. Studies of the warping and blister damage suffered by the P-18/19 fuel assemblies during transient tests revealed that the blistering is related to the original fabrication of the assemblies and that the warping is a result of the severe temperature gradients developed during the transient experiments. Fuel and poison assay measurements on groups of fuel-bearing components and control rods of the Spert II B core revealed that the relative fuel and poison content within each respective group of components is satisfactorily uniform for operational purposes. Tests were performed on the spatial distribution of coolant through Spert III reactor as a function of the system temperature, pressure, and total flow. The results indicated the flow distribution to be relatively insensitive to those parameters. An IBM-650 program was coded for computing the temperature distribution in a fuel plate and the heat flow from the plate to the coolant as a function of time during a reactor transient. A simple model is developed to explain the effect of reflected neutrons upon reactor kinetics. It is shown that the reactivity worth of the reflector and the neutron lifetime in the reflector enter in modifying the usual transfer function and inhour formula for the case of the unreflected reactor. (For preceding period see IDO-16584.). (C.J.G.)

23689 IDO-16614
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
DISTRIBUTIONS OF NEUTRON DENSITY AND NEUTRON FLUX. W. B. Lewis and G. D. Marshall. July 22, 1960. 19p. Contract AT(10-1)-205. OTS.

Rules are given for constructing a neutron spectrum from three measurements: a thermal flux value, a cadmium ratio, and a fast flux value. The physical interpretation of a spectrum is discussed, and various distributions are derived. (auth)

23690 JAERI-4014
Japan Atomic Energy Research Inst., Tokyo.
DESCRIPTION AND HAZARD ANALYSIS OF SEMI-HOMOGENEOUS EXPERIMENT. Report No. 14. Kazuhiko Inoue, Masashi Iizumi, Atsuyoshi Morishima, W. Y. Kato, Kenji Sumita, and Kazuo Nishimura. Jan. 1959. 36p.

A description and hazards analysis of the Semi-Homogeneous Experiment (SHE) are presented. The core consists of an array of graphite tubes and fuel elements. Flexibility is achieved by arrangement of fissile, fertile, and graphite disks. (C.J.G.)

23691 KAPL-2000-10
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR TECHNOLOGY REPORT NO. 13. ENGINEERING. June 1960. 194p. Contract W-31-109-Eng-52. OTS.

Plate collapse tests and wear of control rod Zircaloy-bearing surfaces are discussed. Power plant component design is considered in terms of vibration of condenser tubes, procedure for sizing PWR pressurizers, and effects of check valve slamming on the steam generator pass partition plate using a lumped parameter model. HILO, a PWR steady-state analysis program, and SPY(D1G), reactor thermal transients program, are described. A stability analysis of finite difference representation of the energy equation and correlation of friction coefficient with surface roughness geometry are considered. The designs for the L-42 hot reloadable in-pile irradiation facility, HB-1 in-pile loop, and main coolant check valve test loop are discussed. Measurements are summarized in terms of neutron flux and fuel distribution, problems with flux wire systems, in-core flux transient measurements, use of gamma spectrometry for estimating primary system corrosion rates and radiochemical crud buildup, alpha counting of reactor grade Zr and U–Zr alloys, eddy-current crack detection in short Zircaloy tubing, thickness of a welded Monel overlay on carbon steel, and an eddy-current gage for measuring channel spacing. A code for the general solution of a conical shell subject to axisymmetric loads is described. Bending stresses in a pressure vessel with an integral flat head are discussed. The design of a high flux protective circuit for nuclear power plants is given. Manufacturing design and feasibility considerations for joining materials to form rectangular test sections are presented. Separate abstracts were prepared for 19 sections of the report. (For preceding period see KAPL-2000-6.) (W.D.M.)

23692 KAPL-2000-10(p.B.10-B.32)
Knolls Atomic Power Lab., Schenectady, N. Y.
PROCEDURE FOR SIZING PRESSURIZERS FOR PRESSURIZED WATER REACTORS. C. W. Sorenson.

The derivation and application of the equations relating the pressure variations during single surges to the size of the pressurizer in pressurized water reactor systems are presented. Techniques for analyzing the performance of a given pressurizer during more complicated surge cycles are given. The methods presented allow pressurizer performance calculations to be made quickly without the need for a computer. (W.D.M.)

23693 KAPL-2000-10(p.D.1-D.7)
Knolls Atomic Power Lab., Schenectady, N. Y.
DESIGN OF L-42 HOT RELOADABLE IN-PILE IRRADIATION FACILITY. F. P. Crimi.

The L-42 irradiation facility is a vertical, dynamic water loop which was installed in the L-42 position of MTR. The loop, which consists of an in-pile pressure tube and thermocouple leadout system, has been in operation for one year. The experiments may be unloaded, examined, and then hot-reloaded into the loop. Design of the pressure tube and closures is illustrated. (W.D.M.)

23694 KAPL-2000-10(p.D.7-D.12)
Knolls Atomic Power Lab., Schenectady, N. Y.
HB-1 IN-PILE LOOP DESIGN. P. Ropitzky and F. P. Crimi.

The HB-1 facility is a pressurized water loop in the MTR used for irradiating materials under simulated reactor conditions. The in-pile portion of the loop penetrates the reflector in a horizontal position. Modifications to the loop are described which should make it more valuable and flexible and less costly to operate. (W.D.M.)

23695 KAPL-2000-10(p.E.1-E.8)
Knolls Atomic Power Lab., Schenectady, N. Y.
NEUTRON FLUX AND FUEL DISTRIBUTION MEASUREMENT SYSTEM. J. E. Morin.

The design and operation of the Activation Wire Drive System are described. Flux distribution measurements are obtained by driving activation wires into 42 instrument thimbles, built into the reactor core, where they are activated at a constant power level for a fixed time. Burnup information is obtained by driving burnup wires into certain selected thimbles for long-time irradiation. (W.D.M.)

23696 KAPL-2000-10(p.E.9-E.10)
Knolls Atomic Power Lab., Schenectady, N. Y.
PROBLEMS ENCOUNTERED WITH FLUX WIRE SYSTEMS. R. R. Glynn.

During a routine flux distribution run performed at KAPL after approximately 16 months of operation of the reactor, flux wires could not be inserted to the bottom of 12 of the 12 core thimbles used for the run. Four burnup wires inserted into the core earlier were found to be stuck in the thimbles. Cleaning of the thimbles and removal of the burnup wires are discussed. (W.D.M.)

23697 KAPL-M-ECH-7
Knolls Atomic Power Lab., Schenectady, N. Y.
AN IMPROVED GENERALIZED ANALYSIS OF FISSION FRAGMENT POISONING—THERMAL AND RESONANCE FISSION FRAGMENT CROSS SECTIONS. E. C. Hansen and C. R. Greenhow. July 11, 1960. 43p. Contract W-31-109-Eng-52. OTS.

An analysis for predicting the poisoning of power reactors by fission fragments as a function of the spectral index and fuel depletion is presented. The effect of temperature was investigated. The analysis is employed to obtain results which are appropriate for integration with KARE. These results are presented. (auth)

23698 ORNL-2449
Oak Ridge National Lab., Tenn.
STANDARD OPERATING PROCEDURE FOR THE POOL

CRITICAL ASSEMBLY. E. B. Johnson. Aug. 29, 1960. 30p. Contract W-7405-eng-26. OTS.

Standard operating procedure for the Pool Critical Assembly, a standard pool type reactor fueled with nine enriched plates, is outlined. (C.J.G.)

23699 SCTM-190-60(14)
Sandia Corp., Albuquerque, N. Mex.
A TRANSISTORIZED REACTIVITY MEASUREMENT SYSTEM. Leonard Ehrman. July 6, 1960. 26p. OTS.

An all-transistor system was developed to be used in measuring the reactivity of the reactor in the Sandia Engineering Reactor Facility. In operation, the system triggers a pulsed neutron source in the reactor and counts the resulting neutron flux, thus giving a measure of the time constant of the reactor. The counting is done in eleven time-sequenced counting channels. The reactor time constant is a measure of the reactivity. (auth)

23700
SUBCRITICAL ASSEMBLIES WITH SPONTANEOUS FISSION SOURCE. Pekka Jauho. Ann. Acad. Sci. Fennicae Ser. A VI, No. 41, 1-16(1960). (In English)

With the aid of the integro-differential Boltzmann equation for the flux in a bare subcritical assembly, a theoretical expression for the absolute value of the flux caused by spontaneous fission neutrons was derived. In the derivation it was assumed that Fourier transforms of the slowing down kernels depend only on the absolute value of the buckling vector and further that the energy spectra for spontaneous and induced fission neutrons are identical. The correction in the value of the flux due to the presence of the moderator was discussed, and an expression for this correction was derived. The theory was then applied to measurements made with the aid of the natural uranium-light water subcritical assembly of Finland's Institute of Technology. The result obtained for the spontaneous fission half life was $(6.5 \pm 2.0) \cdot 10^{15}$y. (auth)

23701
NEUTRON THERMALIZATION: ASYMPTOTIC SPECTRUM AND DIFFUSION LENGTH IN A HEAVY GAS WITH ARBITRARY ABSORPTION. Jouko Virkkunen (Inst. of Tech., Helsinki). Ann. Acad. Sci. Fennicae. Ser. A VI, No. 43, 1-27(1960). (In English)

The energy dependent diffusion equation was derived from the Boltzmann equation by means of the spherical harmonics method and the heavy gas model. The neutron flux per unit energy and the thermal diffusion length were calculated by means of the Feenberg perturbation formula supposing a source-free medium with constant scattering cross section and arbitrary absorption. Numerical results refer to the case of 1/v-absorption. The method itself is applicable without these restrictions. Formulas are given to calculate the mean velocity, the mean inverse velocity, and the mean energy of the neutron spectrum as well as the neutron temperature. These results, which do not contain the 1/E-tail of the spectrum, are compared with the results reported in the literature. (auth)

23702
THE CRITICAL ASSEMBLY—A NUCLEAR ANALOG. Joel W. Chastain, Jr. Battelle Tech. Rev. 9, No. 9, 3-9 (1960) Sept.

Use of a critical assembly makes it possible to obtain specific design information more quickly and more accurately than any other method. Since the amount, type, and arrangement of materials in the assembly is the same as in the planned prototype, it is an effective analog device from which physics data can be obtained. The specific uses, experimental objectives, equipment, instrumentation and safety systems, and typical programs of critical assemblies are discussed. (M.C.G.)

23703
CALIBRATION OF MANGANESE AND GOLD FOILS FOR RELATIVE NEUTRON FLUX MEASUREMENTS. K. G. Stephens and W. M. Cooper (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). Brit. J. Appl. Phys. 11, 342-5(1960) Aug.

The usual method of intercalibrating foils for relative flux measurements, made by comparing the β^- activities of the foils after exposure to the same neutron flux, was compared with a method dependent on weighing the foils. The mass intercalibrations agree to within ± 1% of the activity intercalibrations for gold and manganese foils in the range 90 to 100 mg/cm^2 thick if a theoretical correction estimating the β^- absorption in the foil is applied to the measured mass values. (auth)

23704
METHODS TO MEASURE PHYSICAL PARAMETERS OF HETEROGENEOUS REACTORS CORE BY EXPONENTIAL EXPERIENCES. PART 1. S. Tassan (Brookhaven National Lab., Upton, N. Y.). Energia nucleare (Milan) 7, 526-31(1960) Aug. (In Italian)

A short survey was made of the exponential piles and miniature lattices used to determine the physical parameters of heterogeneous reactor cores. The activation techniques of detectors generally employed for measuring neutron flux were described. (auth)

23705
ON THE EFFECTIVE BOUNDARY CONDITION METHOD FOR CALCULATING THE CRITICAL DIMENSIONS OF REFLECTED REACTORS. V. C. Boffi and V. G. Molinari (Comitato Nazionale per le Ricerche Nucleari, Rome). Energia nucleare (Milan) 7, 532-6(1960) Aug. (In English)

A new procedure was developed for calculating the critical dimensions of reflected reactors. It was carried out by using the method of the effective boundary condition in the frame of two-group diffusion theory. (auth)

23706
CONTROL RODS AND ABSORBER IN REACTOR DESIGN. H. T. Richardson. G. E. C. Atomic Energy Rev. 2, 162-71(1960).

The primary requirement in the design of modern reactor systems is safety. For this the designer must ensure that the control system can shut the reactor down under all possible circumstances with an adequate shutdown margin. Neutron absorbers are divided into various groups and the function of each group is discussed. The reactivity investment in the control system, control-rod distribution and effectiveness, and most-effective absorber patterns are discussed. A curve is given showing the axial flux distortion due to partial insertion of control rods. Methods used in the calculation of control-rod effectiveness are outlined. (B.O.G.)

23707
ENERGY DISTRIBUTION OF THERMAL NEUTRONS IN A FINITE SOLID MODERATOR ASSEMBLY. Sudhanshu S. Jha (Tata Inst. of Fundamental Research, Bombay). J. Nuclear Energy, Pt. A. Reactor Sci. 12, 89-92(1960) June.

The equilibrium neutron energy spectrum inside a finite Be assembly was calculated by solving the energy-dependent Boltzmann diffusion equation by numerical iteration. A pulsed source of neutrons at time t = 0 was assumed. A reasonable approximation to the values given by Bhandari for the transport cross-sections was used. For small assemblies the spectrum found to deviate appreciably from the Maxwellian, particularly in the low energy region.

The calculations also gave the values of the decay constant λ of neutrons in different sizes of the assembly. (auth)

23708

SOME PROPERTIES OF TRANSPORT FLUX AND CURRENT AT THE SURFACE OF GREY PLATES. A. Jeffrey (Rolls Royce, Ltd., Derby, Eng.). J. Nuclear Energy, Pt. A. Reactor Sci. 12, 93-100(1960) June.

The spherical harmonics method was applied to an infinite grey slab immersed in a scattering and absorbing medium in which isotropic unit-strength, uniformly-distributed sources were present. Transport flux and current properties were examined at the plate, and extrapolation lengths into the plate were given for a wide range of compositions of plate and surrounding material. The convergence of the odd-order spherical harmonics solution was examined up to order thirteen. Diffusion-theory estimates of neutron current based on extrapolation length were compared with the results of P_{13} spherical harmonic calculations and a modified extrapolation length was suggested. (auth)

23709

THE APPROXIMATE SEPARATION OF KINETICS PROBLEMS INTO TIME AND SPACE FUNCTIONS BY A VARIATIONAL PRINCIPLE. Jeffery Lewins (Brookhaven National Lab., Upton, N. Y.). J. Nuclear Energy, Pt. A. Reactor Sci. 12, 108-12(1960) June.

The time-dependent adjoint density and a variational principle were used to find a consistent separated solution approximation for non-separable problems in reactor kinetics. It was shown that the best average time-independent equations for the flux shape during this interval enabled the best value of the logarithmic derivative of the flux to be obtained. (auth)

23710

EFFECTIVE FISSION AND CAPTURE CROSS-SECTIONS FOR HARDENED MAXWELLIAN NEUTRON SPECTRA. C. H. Westcott (Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Nuclear Energy, Pt. A. Reactor Sci. 12, 113-21(1960) June.

Although a hardening of the thermal neutron spectrum within the fuel of a heterogeneous reactor, due to the selective absorption of the slower neutrons, is known to occur, its effect on the effective cross sections to be used is frequently ignored. Sometimes it is treated as the equivalent of raising the neutron temperature. This approximation was examined. For a general treatment, two simple geometries only were considered, but the cross sections of a number of important isotopes, including U^{235} and Pu^{239} and the reactor poisons Sm and Gd, which depart from the $1/\nu$-law, were studied. The hardening effect was found, as expected, to be largest for nuclei whose effective cross sections vary most rapidly with the temperature of the neutrons, but there was no simple rule found relating the effect of hardening with the change in neutron temperature which would give the same change in effective cross section. The numerical results of these calculations were therefore given in the form of sets of coefficients for a double power series in temperature and flux depression due to the absorber causing the spectral hardening. The coefficients were obtained by least squares fitting to the results and an accuracy of fit was obtained which was adequate for any reasonable use of the information. (auth)

23711

BOUNDARY CONDITIONS IN SLAB LATTICES. A. Jeffrey (Rolls-Royce, Ltd., [Littleover, Derby, Eng.]). Nuclear Eng. 5, 363-5(1960) Aug.

A method is derived for approximating the boundary conditions near the control surfaces in a small power-producing reactor. The method is then applied to a lattice problem, for which the results are actual for the flux and current and not based on the asymptotic flux behavior. (B.O.G.)

23712

THE SPRAY COOLED REACTOR. J. G. Collier and P. M. C. Lacey (Atomic Energy Research Establishment, Harwell, Eng.). Nuclear Power 5, No. 52, 68-73(1960) Aug.

Spray evaporation is a method of reactor cooling in which a steam-water mixture is injected into the fuel channels. Characteristics of heat transfer, fluid dynamics, thermodynamics and steam cycles, and reactor physics are discussed for the system. Construction materials for a spray cooled reactor are considered for fuel material as well as canning and structural materials. The design under consideration is for 2.5 Mw at a maximum temperature of 2100°C and reactor operating pressure of 700 psi. (B.O.G.)

23713

A STUDY OF NONLINEAR REACTOR DYNAMICS. A. Z. Akcasu and A. Dalfes (Argonne National Lab., Ill.). Nuclear Sci. and Eng. 8, 89-94(1960) Aug.

The question of nonlinear stability of stationary reactor systems is investigated by two methods. The first method is analytic and sets the theory of nonlinear stability on a firm mathematical basis. The second method makes use of an electrical analogy and is based on the stability criterion stated by Weinberg and Ergen for nonlinear mechanical systems. Both methods deal with reactor systems in which feedback may be nonlinear as well as linear. The effect of delayed neutrons is included in the treatment. The stability conditions previously derived by others are shown to be special cases of the criteria proposed. (auth)

23714

VARIATIONAL REPRESENTATIONS IN REACTOR PHYSICS DERIVED FROM A PHYSICAL PRINCIPLE. Jeffery Lewins (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 8, 95-104(1960) Aug.

A physical axiom is advanced that relates the density of neutrons and their individual contribution to the operationally determinable behavior of a reactor. The variational principle derived from this axiom is of a general form applicable to systems in which the time dependency of the coefficients of the equations prevents a separation into conventional eigenfunctions and eigenvalues. The physical significance of the independent variation of two field functions is investigated. The treatment of the nonseparable systems and the variational principle to which we are led are both independent of any particular physical model employed to represent the system and appear to be applicable to a variety of non-conservative, continuous, and time-dependent systems in mathematical physics. The more well-known properties of the separable problem are derived from the principle as "the exception proving the rule" in an attempt to associate physical meaning with the commonly employed forms. Thus a discussion is given of the relation of the Green's function to both fields and the Joint Error is introduced as a criterion for the completeness of biorthogonal sets. Although the variational principle derived is not applicable to variation of the coefficients of the equations through nonlinearities, it is indicated how the present approach may be extended to account for nonlinearities. (auth)

23715

SOME MONTE CARLO AND ANALYTICAL RESULTS FOR

RESONANCE CAPTURE IN LATTICES. Wolfgang Rothenstein (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 8, 122-7(1960) Aug.

Detailed Monte Carlo studies of the resonance capture in the lowest U^{238} resonances were made for uranium-water lattices and a uranium-graphite lattice. Direct comparison with calculated values was considered a good test of the validity of the assumptions made in obtaining the theoretical estimates. Good agreement was obtained for the over-all capture in a single resonance and for the energy distribution of absorptions. Monte Carlo tests also showed that the asymptotic flux was fairly well re-established between the two strongest U^{238} resonances, and that the number of neutrons captured in this energy region was only slightly affected by Doppler broadening and interference between resonance and potential scattering. Finally the calculated resonance escape probability in a uranium-water lattice for 26 resolved resonances was compared with the Monte Carlo value. There was quite close agreement. (auth)

23716

THE STABILITY OF "STABLE" FISSION-PRODUCT POISONING. S. B. Gunst (Westinghouse Electric Corp., Pittsburgh), J. C. Connor, and E. Fast. Nuclear Sci. and Eng. 8, 128-32(1960) Aug.

In reactor-lifetime calculations it is customary to take account of the transient behavior of two fission product poisons, Xe^{135} and Sm^{149}, and to assume the gross poisoning due to all other products is a function of the total time-integrated exposure irrespective of the detailed flux history. This description tacitly assumes that the gross poisoning of the other products is stable. The adequacy of the description is demonstrated experimentally for a natural UO_2 sample irradiated in a reactor flux of 2×10^{14} n/cm^2-sec to an exposure of 6300 Mwd/ton. The poisoning associated with the so-called "stable" fission products is found to change only (−7 ± 3) barns/fission per year. (auth)

23717

A NUMERICAL TECHNIQUE FOR SOLVING GROUP DIFFUSION EQUATIONS. Eugene L. Wachspress (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 8, 164-70(1960) Aug.

An efficient method for solving group diffusion equations is described. Application of the Perron Frobenius theory of non-negative matrices allows a direct determination of reactor criticality without calculation of neutron fluxes. Higher flux modes may also be found. Simultaneous calculation of all flux groups simplifies formulation with inelastic- and up-scattering, and also provides a convenient tool for some kinetics studies. (auth)

23718

AGE OF U^{233} FISSION NEUTRONS IN WATER. W. G. Pettus (Babcock and Wilcox Co., Lynchburg, Va.). Nuclear Sci. and Eng. 8, 171(1960) Aug.

Recent calculations indicated that the age of fission neutrons is somewhat smaller for U^{233} than for U^{235}. Because of the possible systematic errors associated with an absolute neutron age measurement in water, a relative measurement was adopted in which the second moments of the indium resonance activation flux from small converter disks of U^{233} and U^{235} were compared under identical experimental conditions. Results indicated that the age of U^{233} neutrons was less than that of U^{235} neutrons by 5 ± 3%. (M.C.G.)

23719

GREULING-GOERTZEL APPROXIMATION IN MUFT IV CODE. E. M. Gelbard (Westinghouse Electric Corp., Pittsburg). Nuclear Sci. and Eng. 8, 171(1960) Aug.

A simplified form of the Grueling-Goertzel equation was coded into MUFT IV, a code written for the IBM-704. This approximation may be selected through an input option. In addition, the full Greuling-Goertzel treatment of nonhydrogenous moderation is available in P1MG, a multigroup space-energy code for the 704. (M.C.G.)

23720

DESIGN OF EXPERIMENTAL GAS-COOLED IN-PILE LOOPS. E. Storto (Oak Ridge National Lab., Tenn.). p.277-92 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

The current Experimental Gas-cooled, In-pile Loop Program at Oak Ridge National Laboratory was discussed in terms of objectives, scope, and nature of facilities. A basic concept for loop design was briefly described, and attention was given to engineering considerations peculiar to in-pile applications. (auth)

23721

THE PRTR GAS-COOLED LOOP. D. E. Baker, J. F. Fletcher, and D. P. Schively (General Electric Co., Richland, Wash.). p.313-25 of "Gas-Cooled Reactors. A Symposium of The Franklin Institute and The American Nuclear Society, Delaware Valley Section, 1960, Philadelphia." Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7.

A recirculating gas loop, designed as a new experimental facility, will be installed in the Plutonium Recycle Test Reactor at Hanford. The loop utilizes carbon dioxide coolant at flows up to 15,000 lb/hr at 500 psig pressure with a maximum gas temperature of 1500°F. The loop includes an in-reactor test section and a similar ex-reactor test section. Also included in the loop equipment are a spun ceramic filter, a NaK bath pre-heater, and centrifugal gas blowers that utilize self-acting gas bearings. The loop is primarily designed for dynamic studies of the graphite-CO_2 reaction, but it is also capable of operating with fuel elements of up to 500 kw heat generation. (auth)

23722

TECHNOLOGY, ENGINEERING AND SAFETY. VOLUME 2. R. Hurst, R. N. Lyon, and C. M. Nicholls, eds. Progress in Nuclear Energy. Series IV. New York, Pergamon Press, 1960. 825p. $15.00.

Papers presented at the 1958 Geneva Conference are included and contain information in the wide chemical, metallurgical, and engineering fields generally known as "reactor technology." It is intended to present a unified theme, irrespective of the country or laboratory from which the work originated. Review papers were favored rather than original work although a few do fall into this latter category. The papers are grouped under the following headings: Reactor Chemistry, Reactor Materials, Engineering Experience and Practice, Engineering Studies, and Engineering Aspects of Reactor Safety. (B.O.G.)

23723

ELEMENTARY INTRODUCTION TO NUCLEAR REACTOR PHYSICS. S. E. Liverhant. New York, John Wiley & Sons, Inc., 1960. 459p. $9.75.

The principles of neutron chain reactors are treated on a level suitable for undergraduates in physics and engineering and for those who are working in this field and require the basic concepts and techniques of reactor calculations. The purpose here is to acquaint the reader with almost all the fundamental ideas and problems encountered in reactor engineering. Mathematical rigor was subordinated to the demands for clarity of the underlying physical concepts and their practical application to design problems in reactor physics and engineering. A basic course in nuclear physics is included. (B.O.G.)

23724

IMPROVEMENTS RELATING TO GAS SAMPLING APPARATUS. Donald Stanley Pettinger (to A. E. I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 844,058. Aug. 10, 1960.

A gas selector valve was invented for sampling the core channels of gas-cooled reactors; it comprises a plurality of inlet gas ducts arranged with a selector arm in such a way that, in operation, each inlet gas duct registers first with the scavenging port and then the sampling port. Means is also provided for connecting any of the individual gas lines to individual sampling apparatus. (D.L.C.)

23725

IMPROVEMENTS IN AND RELATING TO MECHANICAL HANDLING MEANS, MORE PARTICULARLY FOR LOADING AND UNLOADING NUCLEAR REACTORS OF THE SOLID FUEL TYPE. William Allan Russell (to Hawker Siddeley Nuclear Power Co., Ltd.). British Patent 844,168. Aug. 10, 1960.

A mechanical handling device was invented for loading and unloading reactors of the solid fuel type. The device comprises a tube with associated pivotal arms arranged in such a way that, when it is inserted into the charge holes of the pressure vessel, the arm nearest the fuel channels is vertical. The location of the tube over each channel is facilitated by raised edges around the channels, and a grab in the tube is provided for holding the fuel. The advantages of this method of loading and unloading are that the possibility of fuel damage by passing around sharp corners is eliminated and the required number of charge holes is reduced. (D.L.C.)

23726

IMPROVEMENTS IN OR RELATING TO PRESSURE VESSELS FOR NUCLEAR REACTORS. Raymond Hicks and Michael Bayer (to General Electric Co., Ltd.). British Patent 844,188. Aug. 10, 1960.

A pressure vessel shape was devised for heterogeneous reactors which combines high pressure strength with minimum waste space. The shape is that of a barrel with curved end caps, intermediate between a cylinder (minimum waste space) and a sphere (high pressure strength). (D.L.C.)

23727

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Piyatilleke Perera Guneratne (to United Kingdom Atomic Energy Authority). British Patent 844,211. Aug. 10, 1960.

A thermocouple arrangement was devised for measuring the reactor fuel temperature which achieves accuracy by locating the hot junction within the fuel member rather than in the sheath as in conventional thermocouples. The hot junction and connecting cable are inserted in the fuel member during its fabrication (casting or sintering), and hence they or their outer surfaces must have a higher m.p. than the fuel and not alloy with it; suitable protective coatings for use in conjunction with a U fuel member are Nb and Ta. Configurations are given for a U fuel member with a finned Mg alloy sheath and a stainless steel sheathed thermocouple cable which has a Nb covering inside the member. Instructions are given for fabricating the various parts. (D.L.C.)

23728

IMPROVEMENTS IN OR RELATING TO PRESSURE VESSEL ASSEMBLIES. Jack Jones Griffiths (to United Kingdom Atomic Energy Authority). British Patent 844,401. Aug. 10, 1960.

A pressure vessel for a gas-cooled thermal reactor was designed whose support member also incorporates the coolant inlet duct. In this way, the most highly stressed parts of the support, namely the region where the pressure vessel joins the support chamber, can be maintained at a uniform (coolant) temperature, thereby avoiding thermal stresses. (D.L.C.)

23729

IMPROVEMENTS RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Selchouk Ahmed Ghalib, Douglas Francis Welch, Derek Randall Smith, and Geoffrey Alfred Roberts (to British Thomson-Houston Co., Ltd.). British Patent 844,606. Aug. 17, 1960.

An arrangement is described for fuel rods in graphite-moderated reactors in which each rod is supported in a cage, thereby relieving the rods of undesirable stress, especially in vertical stacking, and allowing them to expand both longitudinally and radially. The cages must be made of heat-resistant and low neutron-absorbent materials such as Zr alloys or Be. Drawings and construction details are given for cages for finned rods. (D.L.C.)

23730

NUCLEAR REACTOR. (to U. S. Atomic Energy Commission). British Patent 844,711. Aug. 17, 1960.

A reactor was invented in which the advantages of D_2O as moderator and liquid metal as coolant are combined without the use of a pressure vessel. The reactor comprises conduits containing fuel rods and metal coolant running through a tank of D_2O, the conduits being separated from D_2O by a jacket of inert gas, thereby keeping D_2O from boiling. Devices for leak detection are described. The advantages of this reactor design are that, besides the elimination of the pressure vessel, natural or slightly enriched natural uranium can be used as fuel and less fuel can be used. (D.L.C.)

23731

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Robert Norman Dew, Keith James Mitchell, and Ian Alexander Butler Gaunt (to General Electric Co., Ltd.). British Patent 844,764. Aug. 17, 1960.

A loading machine for discharging and charging fuel elements is described for gas-cooled graphite-moderated reactors. Such processes take place from the underside of the core. Advantages of loading under the core include nondisturbance of the moderator, operation of the machine in a cool region (if the coolant flows upward), and separation of the machine from servicing mechanisms on the top. The machine is designed so that the entire contents of a channel can be discharged in one operation, a column of fuel elements can be rearranged by means of a chain conveyer, a group of 30 or 40 channels can be served through a single standpipe, and the power means can be stored within an auxiliary vessel outside the biological shield. A particular configuration of this machine is presented for a CO_2-cooled, graphite-moderated reactor with 3000 vertical channels, each of which accommodates 10 fuel elements. (D.L.C.)

23732

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. David John Ingram (to General Electric Co., Ltd.). British Patent 844,765. Aug. 17, 1960.

A traveling auxiliary vessel capable of attachment to the pressure vessel of a gas-cooled reactor at any one of a number of points was invented for containing servicing mechanisms such as those for ramming, control-rod removal, inserting thermocouple fuel elements, and distance-rod withdrawal. The vessel is mounted on a traveling carriage and arranged so that its outlet pipe can be positioned directly above any of the reactor standpipes. (D.L.C.)

23733
IMPROVEMENTS IN OR RELATING TO GAS SEALS. Robert Norman Dew (to General Electric Co., Ltd.). British Patent 844,766. Aug. 17, 1960.

A gas seal for sealing the doors of the standpipes of a gas-cooled reactor was designed in which bellows action helps to effect a tight seal. (D.L.C.)

23734
IMPROVEMENTS RELATING TO NUCLEAR REACTORS. William George Edgar Wood and Peter Barrington Thomas (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 844,884. Aug. 17, 1960.

A core configuration for gas-cooled graphite-moderated reactors was invented which offsets Wigner growth (growth perpendicular to the grain due to neutron irradiation) and minimizes distortion of fuel and control channels. Since Wigner growth is greatest near the lower part of the core, the configuration comprises an uncompensated zone surrounding a compensated zone, the uncompensated zone being large in the upper part of the core and small in the lower part. Each zone consists of graphite blocks separated by spacer slabs; the grain direction of the blocks is vertical. In the uncompensated zone the slab grain is also vertical, but in the compensated zone the slab consists of two layers whose grains are horizontal and are opposed to each other. (D.L.C.)

23735
IMPROVEMENTS RELATING TO THE CONTROL OF NUCLEAR REACTORS. Leslie Carter Ludbrook and Peter Raymond Joseph French (to British Thomson-Houston Co., Ltd.). British Patent 845,207. Aug. 17, 1960.

An improved arrangement of control rods is proposed for controlling a reactor which gives a nearly linear relationship between the reactivity and the positioning of the control rods. The rods are arranged in groups forming a plurality of concentric circular loops which are raised or lowered independently, with all rods in one group moving simultaneously. The movements of the groups are overlapped so that each group after the first commences to move when the preceding group is at the mid-part of its travel. This overlapping gives a linear reactivity vs position (or time) relationship. Control rods are actuated by a motor powered by cam-fed rectified current. Both the circuitry of the control apparatus and the sequence of operations are given. (D.L.C.)

Power Reactors

23736 APAE-49(Suppl. 1)
Alco Products, Inc., Schenectady, N. Y.
HAZARDS SUMMARY REPORT—PREPACKAGED NUCLEAR POWER PLANT FOR AN ICE CAP LOCATION (PM-2A). E. M. Reiback, ed. Apr. 15, 1960. 28p. Contract DA-30-347-ENG-284.

As a consequence of several design changes in the PM-2A after the preparation of the original Hazards Summary Report, amendments to this report are required to reflect these changes. These amendments are presented. In response to questions from the Danish Government, on whose land this reactor will be built, an addendum was prepared containing additional information which was not in the original Hazards Summary Report. There is no change in the conclusions of the original report. There will be no hazard to personnel when the Nuclear Power Plant is operating under normal conditions, and there is no major hazard to personnel should the maximum credible accident occur. (auth)

23737 CRNE-925
Atomic Energy of Canada Ltd., Chalk River Project, Chalk River, Ont.
PARTIAL ECONOMIC STUDY OF STEAM COOLED HEAVY WATER MODERATED REACTORS. Apr. 1960. 87p. (AECL-1018). AECL.

Steam-cooled reactors are compared with CANDU for costs of Calandria tubes, pressure tubes, heavy water moderator, heavy water reflector, fuel supply, heat exchanger, and turbine generator. A direct-cycle light-steam-cooled heavy-water-moderated pressure-tube reactor formed the basic reactor design for the study. Two methods of steam circulation through the reactor were examined. In both cases the steam was generated outside the reactor and superheated in the reactor core. One method consisted of a series of reactor and steam generator passes. The second method consisted of the Loeffler cycle and its modifications. The fuel was assumed to be natural cylindrical UO_2 pellets sheathed in a hypothetical material with the nuclear properties of Zircaloy, but able to function at temperatures to 900°F. For the conditions assumed, the longer the rod, the higher the outlet temperature and therefore the higher the efficiency. The turbine cycle efficiency was calculated on the assumption that suitable steam generators are available. As the neutron losses to the pressure tubes were significant, an economic analysis of insulated pressure tubes is included. A description of the physics program for steam-cooled reactors is included. Results indicated that power from the steam-cooled reactor would cost 1.4 mills/kwh compared with 1.25 mills/kwh for CANDU. (M.C.G.)

23738 DLCS-1350801
Duquesne Light Co., Shippingport, Penna.
RADIOACTIVE WASTE DISPOSAL SYSTEM. CORE I, SEED 1. SECTION 8. Test Results (T-550089). First issue, Apr. 9, 1960. 7p. OTS.

The operating characteristics and integrity of the waste-disposal monitoring system for the Shippingport PWR were studied. (C.J.G.)

23739 DLCS-1470103
Duquesne Light Co., Shippingport, Penna.
DETERMINATION OF PRIMARY SYSTEM PRESSURE DROP. Test Results (T-550129). First Issue, July 6, 1959. Second Issue, Mar. 15, 1960. 19p. OTS.

Coolant system pressure drop and flow characteristics were determined for the Shippingport Pressurized Water Reactor at periodic intervals throughout the life of the core. (C.J.G.)

23740 DLCS-1490209
Duquesne Light Co., Shippingport, Penna.
CONTROL ROD POSITIONS FOR CRITICALITY 0 EFPH. CORE I, SEED 2. Test Results (T-550130). First issue, July 13, 1960. 20p. OTS.

The critical bank heights and bank worths were determined for four different control rod configurations of the Shippingport Pressurized Water Reactor at 0 EFPH with a coolant temperature of 500°F and a pressure of 1800 psig. (C.J.G.)

23741 DLCS-1840307

Duquesne Light Co., Shippingport, Penna.

PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN. CORE I, SEED I. SECTION 3. Test Results (T-612076). First issue, May 2, 1960. Second issue, June 22, 1960. 10p. OTS.

The effect of isolation and forced draining on the radiation level of the 1AC coolant purification hairpin loop was investigated. The activity in the horizontal and vertical legs (U-bend) of the loop piping was determined by a radiochemical analysis of the crud deposits. (C.J.G.)

23742 DLCS-3000102

Duquesne Light Co., Shippingport, Penna.

RIVER SOUNDINGS. Test Results. First issue, June 22, 1960. 6p. OTS.

Depth measurements were performed in the Screenhouse intake channel and in the Ohio River in the vicinity of the Shippingport PWR Screenhouse. The need for dredging was established. (C.J.G.)

23743 DLCS-3000103

Duquesne Light Co., Shippingport, Penna.

RIVER SOUNDINGS. CORE I, SEED 2. Test Results. First issue, July 18, 1960. 6p. OTS.

Water depth in the intake channel to the coolant-water screenhouse and surrounding area in the Ohio River near the intake channel were measured. From these measurements, the amount of silt removed during a previous dredging was determined. (C.J.G.)

23744 DLCS-3450101

Duquesne Light Co., Shippingport, Penna.

STATION PERFORMANCE DURING AN UNSCHEDULED POWER TRANSIENT. CORE I, SEED 2. Test Results (T-643730). First issue, July 25, 1960. 10p. OTS.

No difficulty was encountered in controlling a power transient in the Shippingport PWR station during a safety shutdown with the station operating at a gross electrical output of 49 Mw. (C.J.G.)

23745 DLCS-3470101

Duquesne Light Co., Shippingport, Penna.

REACTOR AND PRESSURIZER RELIEF VALVE BELLOWS RUPTURE TEST. CORE I, SEED 2. SECTION 1. Test Results (RNI-43). First issue, July 13, 1960. 8p. OTS.

Tests were conducted in March 1960 to determine if the bellows of any PWR pressurizer and reactor self-actuated relief valves were ruptured. It was found that no bellows rupture had occurred and that all bellows pressure sensing devices were operative. (J.R.D.)

23746 DLCS-3570101

Duquesne Light Co., Shippingport, Penna.

REACTOR PLANT CONTAINER INTEGRITY TEST. CORE I, SEED 2. SECTION 1. Test Results (T-643733). First issue, June 29, 1960. 13p. OTS.

Leak rates were determined for each of six air locks located in the Shippingport Pressurized Water Reactor plant container. (C.J.G.)

23747 IDO-19009(Vol.II)

Combustion Engineering, Inc., Nuclear Div., Idaho Falls, Idaho.

ABWR QUARTERLY PROGRESS REPORT FOR OCTOBER 1 TO DECEMBER 31, 1959. VOLUME II. SL-1 HEALTH PHYSICS AND SAFETY. E. J. Vallario. Jan. 15, 1960. 29p. Contract AT(10-1)-967. (CEND-67). OTS.

The health and radiological safety program for the SL-1 reactor is described. Discussions are presented on personnel and area monitoring, radiological testing and evaluations, and industrial safety. (For preceding period see IDO-19005 (Vol.II).) (C.J.G.)

23748 IDO-28544

Aerojet-General Nucleonics, San Ramon, Calif.

ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM MONTHLY PROGRESS REPORT FOR AUGUST 1959. Sept. 30, 1959. 54p. Contract AT(10-1)-880. OTS.

In the Gas Cooled Reactor Experiment-I the BMI-16 in-pile tube was installed and pressure checked. Parallel operation with two blowers was unsuccessful. The lifetime of an ML-1 fuel element was evaluated for two cases. Cross sections were drawn of three IB elements for use in studying neutron scattering. Pressure drops of five basic space designs were compared. Preliminary investigations and reports were completed on a production line scintillation spectrometer to safeguard against mixing pellets of different loadings. A variable-speed rotary welding machine for welding fuel pins was assembled. The test model for the transient heat transfer method was completed. Periodic combustion tube and furnace failures interrupted gas corrosion tests, but creep and tube burst tests were continued. Existing alloys were investigated and did not meet ML-1 design requirements. In-pile testing of the IB-1αT element was completed. Two GCRE production elements were placed in the BMI critical facility for comparison with standard critical assembly elements. Design and development were continued on the solid-moderated, homogeneous GCRE-II. Irradiation of the II-1C capsule was completed, and flux perturbation measurements were made on the II-2C capsule. An investigation was made of the hazards associated with the proposed hot criticality experiment. An analysis of cycle efficiency was completed for a closed-cycle, regenerative gas turbine system under GCRE-II reference operating conditions. Three methods of flattening the radial temperature profiles of the core, other than by fuel variations, were studied. An in-pile loop test element was designed and fabrication methods were developed for both this test element and the reference reactor fuel element. At ML-1 loading mock-ups of power conversion and reactor packages were 90% complete for cross-country roadability and aircraft loading tests. Elastomer shock mounts used on the package were given static and dynamic shock tests. The transmissivity of the shield for the ML-1 15-ton reference design was studied. Corrosion tests with ammonium pentaborate for shielding showed that it was unstable above 150°F. At the Gas Turbine Test Facility design information was provided for open cycle piping. (M.C.G.)

23749 KAPL-2000-10(p.C.2-C.7)

Knolls Atomic Power Lab., Schenectady, N. Y.

SPY(D1G), A COMPUTER PROGRAM FOR THE CALCULATION OF REACTOR THERMAL TRANSIENTS. R. B. Taylor.

The SPY(D1G) program is an IBM-704 program developed specifically for the calculation of thermal transients occurring in a one-pass nuclear reactor system with three primary coolant loops. The program has the computing ability to provide the calculations for the analysis of reactor thermal transients that result from complete and sequential loss-of-flow accidents, cold water accidents, startup accidents, and other accidents which may be simulated by externally controlled variations in reactivity. SPY-1 and SPY-2 are described. (W.D.M.)

23750 KAPL-2000-10(p.E.10-E.16)

Knolls Atomic Power Lab., Schenectady, N. Y.

IN-CORE NEUTRON FLUX TRANSIENT MEASUREMENTS FOR POWER REACTORS. K. E. Watkins.

To perform neutron flux transient measurements within a power reactor core, neutron sensors must be of small physical size and must be able to operate under temperatures of 400 to 600°F, radiation of tens to hundreds of megaroentgens per hour, and thermal neutron fluxes of 10^{12} to 10^{14} n/cm^2-sec. The insertion, positioning, and removal of such devices within the core introduces complexities of a mechanical nature. An ion chamber and thermopile developed for the extreme environments and mechanical restrictions are described. (W.D.M.)

23751 KAPL-2000-10(p.F.12-F.28)
Knolls Atomic Power Lab., Schenectady, N. Y.
HIGH FLUX PROTECTIVE CIRCUIT FOR NUCLEAR POWER PLANTS. H. W. Bishop.

A special electrical control circuit with the specific protective function of limiting the maximum power that may be generated within a reactor has been designed. The circuit detects excessive reactor power levels and initiates a shutdown signal. The circuits are composed of two amplifiers, a floating level trip amplifier, and a high flux trip amplifier. The amplifiers are cascaded and operate as a bistable. (W.D.M.)

23752 MND-M-1815
Martin Co. Nuclear Div., Baltimore.
PM-1 NUCLEAR POWER PLANT PROGRAM. Quarterly Progress Report No. 4 [for] December 1, 1959 to February 29, 1960. E. H. Smith. Apr. 5, 1960. 307p. Contract AT(30-1)-2345. OTS.

The objective of the contract is the design, development, fabrication, installation, and initial testing and operation of a prepackaged air-transportable pressurized water reactor nuclear power plant, the PM-1. The specified output is 1 Mw(e) and 7 million Btu/hr of heat. The plant is to be operational by March 1962. The principal efforts during the quarter were the near-completion of the final design and preparation of specifications for plant components. The entire power plant has been divided, for final design purposes, into 37 subsystems. The status of work on each subsystem at the close of the period is reported. A revised summary of design parameters is given, with flow diagrams of the primary and secondary systems. The final design work will be concluded early in the next report period. Systems development work included full-scale structural testing of a test package, preparation for a loading demonstration and testing of the air-steam condenser model. Reactor development work included: (1) Final preparations for the flexible zero-power test (PMZ-1) program. (2) Final preparations for the revised fuel element irradiation test program. (3) Continuation of reactor flow tests. One-fourth-scale model flow tests were completed and preparations for bundle flow and full-scale tests were continued. (4) Further work on the heat transfer test program, including fabrication, installation and testing of test section STTS-3, and fabrication of test sections STTS-4 and SETCH-2. (5) Final design and fabrication of the prototype magnetic jack-type control rod actuators. Work continued on study of control rod materials, with emphasis on fabrication techniques and stabilization of rare earth oxides. (For preceding period see MND-M-1814.). (auth)

23753 NAA-SR-4791
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
PIQUA OMR HIGH BOILER HANDLING. R. R. Stiens. Aug. 30, 1960. 54p. Contract AT-11-1-GEN-8. OTS.

A combustion process for disposal of the waste polymer produced by radiation and thermal effects on the organic coolant was developed. A full scale prototype of a Piqua Power Reactor High Boiler Handling System was designed and constructed. A Vortex burner, designed to handle asphaltic type wastes, was selected. Required fuel temperature was found to be 300 to 400°F. (C.J.G.)

23754 NAA-SR-4894
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
OPERATION OF THE PIQUA OMR DEGASIFICATION SYSTEM PROTOTYPE. G. W. Corporales and P. R. Benson. Aug. 30, 1960. 36p. Contract AT-11-1-GEN-8. OTS.

A quarter-scale prototype of the Piqua OMR degasification system was designed, constructed, and operated. Results of operation indicate that the proposed system will be satisfactory to meet degasification requirements previously established for the Piqua reactor. These requirements are to remove pyrolytic and radiolytic gases and 8 lbs/hr of H_2O from the organic coolant; maintaining the H_2O concentration at or below 200 ppm. An experimental evaluation of the Piqua pressure control scheme was conducted; it showed that reactor pressure could be controlled within about 2 psi under normal operating conditions. (auth)

23755 NAA-SR-Memo-4802
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
PROTOTYPE FREEZE TRAP TEST. R. Cygan. Dec. 29, 1959. 6p. OTS.

A performance evaluation was made of a prototype liquid cooled freeze trap with sodium at 350 and 1000°F. The sodium freeze-off function was adequate for all test conditions encountered. The freeze-off occurred satisfactorily with the larger clearance provided by a test modification to provide 0.030 eccentricity to the rotating shaft. Turning the freeze-trap handle was successful in opening the unit for gas venting when 350°F sodium was used. For a seal formed with 1000°F sodium, 16 turns of the trap handle gave no measurable gas venting at pressures up to 30 psi. Melting out the seal opened the vent satisfactorily. All the major problems encountered during the test were mechanical and associated with the rotating feature of the unit. (M.C.G.)

23756 NAA-SR-Memo-4934
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
14-INCH SWING CHECK VALVE TEST. R. Cygan. Feb. 10, 1960. 5p. OTS.

The check valve for the Hallam Power Reactor uses a knife-edge bearing for the flapper in place of the usual journal-type bearing. Mechanical cycling in sodium at 600°F was used to check operation of this bearing. A total of 309 mechanical cycles was completed with no apparent malfunctioning of the valve. Measured leakage rates were 0.46 gpm at 0.93 psig, 0.73 gpm at 3.4 psig, and 0.32 gpm at 5.9 psig. (M.C.G.)

23757 ORNL-2061(Pts. I, II, and III)(Del.)
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 10, 1956. June 13, 1956. Decl. with deletions Nov. 10, 1959. 225p. Contract W-7405-eng-26. OTS.

Reactor Theory, Component Development, and Construction. Detailed layouts were completed on all major subassemblies of the ART. Recent calculations have indicated that the heat flux through the core shells of the ART will be higher than previously estimated. The thickness of the lead portion of the reactor shield was reduced from 7 to 4.3 in.

to obtain space for increased neutron shielding around the pumps. Studies of flow in a full-scale plastic model of the core were continued. Flow diagrams and instrumentation lists were prepared for the Engineering Test Unit (ETU), which is a nonnuclear mockup of the ART. Modifications were made in the proposed ART control system on the basis of information obtained with the reactor simulator. Three separate calculations of the activity that will be produced in the NaK in the fuel-to-NaK heat exchangers of the ART were normalized to the current ART design. An estimate was made of the activity to be expected in the ART radiators because of the deposition on the radiator tubes or header walls of constituents of Inconel that will become activated in the heat exchangers and will be carried to the radiators in the NaK stream. A calculation of the self-absorption of decay gamma rays in the ART fuel dump tank indicated a value of 90%, and therefore cooling facilities must be provided to remove almost all the decay heat. Disassembly and sectioning of in-pile loop No. 3 which operated in the MTR were completed. Synthetic lubricants in the UCON LB series were investigated to determine their stability as pump lubricating fluids in the ART. Additional tests of the performance of the ART sodium pump with water were made. Difficulties were encountered in high-temperature tests of the fuel pump with NaK. Operations were continued on heat exchanger stands. A stand for testing the thermal stability of the outer core shell of the ART is in operation. Materials Research. Additional phase-equilibrium studies were carried out in several fluoride systems in order to gain a better understanding of the structure and to aid in devising improved fuels. A material containing $NaF-ZrF_4-UF_4$ was found to show promise as a lower melting, nonsegregating substitute for Na_2UF_6 as a fuel concentrate for reactor systems. Studies were made on the UF_4-UO_2 system which led to a value of 1034°C for the melting point of pure UF_4. Experimental work was carried out in the following Zr-bearing systems: $KF-ZrF_4$, $RbF-ZrF_4$, and $NaF-KF-ZrF_4$. Thermal analysis data were obtained on the $RbF-BeF_2$ system. The program for studying chemical reactions of molten fluorides was continued. Studies of the reactions of Ta and W with UF_4 in NaK-LiF-KF eutectic showed that neither metal was stable and that they offered little or no advantage over Cr. The effects on corrosion of varying the ratio of hot-leg surface area to volume of fluoride fuel mixture in a forced-circulation Inconel loop were investigated. Examinations of two forced-circulation loops that had operated with the fuel mixture NaF-KF-LiF (UF_4 + UF_3) clearly demonstrated that the presence of U^{3+} in such a mixture is very effective in reducing hot-leg attack. Two Inconel forced-circulation loops in which NaK was circulated completed 1000 hr of operation with a temperature gradient of 300°F and a maximum fluid temperature of 1500°F. Examinations of two Hastelloy B thermal connection loops operated for 500 hr with an alkali metal fluoride mixture containing UF_4 at a maximum temperature of 1500°F showed the maximum attack to be less than 2 mils. Inconel tube-to-header joints brazed with Ni-Cr-Ge-Si low-cross-section alloys were tested in Na, NaK, and $NaF-ZrF_4-UF_4$ in seewaw apparatus. One specimen of Sm_2O_3 and two specimens of a commercial rare-earth oxide mixture (Sm_2O_3 + Gd_2O_3) were tested in static sodium in Inconel containers at 1500°F. Two type 316 stainless steel thermal-convection loops were operated with Na to study the effect of a diffusion cold trap on the amount of corrosion and mass transfer observed in such a system. A series of differential-thermal-analysis was performed to determine the solubility of Li in NaK. Nine Ni- and Fe-base alloys of special compositions were prepared and were subjected to static corrosion tests in NaOH for 100 hr at 1500°F Screening tests of elastomers for possible use as valve seat materials in NaK circuits were initiated. A search for a moderator that can be cooled by direct contact with the molten fluoride fuel mixture was initiated. Experiments are underway in which the activation analysis is being used to study the diffusion of Cr in Inconel. Metallographic investigations are under way on NaK-to-air radiators that failed after various periods of service at high temperatures. The creep-rupture testing program for Inconel was nearly completed. The reactions which occur between Inconel and metal borides, oxides, nitrides, carbides, and carbonitrides were determined at temperatures between 1100 and 2000°F. Extensive compatibility tests of UO_2 and Nb, both powdered and wrought, were carried out by heating for 500 hr at 1000°C. Methods are being studied for preparing compacts of Sm and Gd oxides and cermets of Fe and rare-earth oxides and Ni and rare-earth oxides for use in reactor control elements. Preliminary heat-transfer data were obtained for molten $NaF-KF-LiF-UF_4$ flowing through Hastelloy B tubes in a pressurized forced-convection system. A study of the effect of composition on heat capacity for $NaF-ZrF_4$ salt mixtures was investigated. The effects of irradiation on the corrosion of Inconel exposed to a fluoride fuel mixture and on the physical and chemical stability of the fuel mixture were investigated. A spectrophotometric method for the determination of trace amounts of Ti in mixtures of fluoride salts was developed. Studies were continued on the bromination method for the determination of combined oxygen in fluoride salts. (W.L.H.)

23758 PRDC-TR-34
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] APRIL 1960.
22p. Contract AT(11-1)-476. OTS.

Research and development activities on the Fermi Fast Breeder Reactor are summarized in terms of core design, materials and metallurgy, nuclear engineering, Reactor vessel engineering, electrical engineering and instrumentation, liquid metal and steam systems, and test operations. Environmental radioactivity data are also included. (J.R.D.)

23759 SRO-35
Savannah River Operations Office, AEC.
HEAVY WATER POWER REACTOR PROGRAM. Monthly Progress Report [for] July 1960. 22p. OTS.

A summation of development activities on various heavy-water power reactors under AEC contract is presented. Components development for various critical and subcritical facilities is discussed. The design, cost and construction-time estimates, and results of tests on components of the Savannah River Components Test Reactor (HWCTR) are presented. The status of programs on beryllium development, cladding and fuel element fabrication, and the Parr Shoals Power Reactor is discussed. (C.J.G.)

23760 TID-3089
Office of Technical Information Extension, AEC.
ECONOMICS OF NUCLEAR POWER. A Bibliography of Selected Literature. William E. Bost, comp. Jan. 1960. 89p. OTS.

Included are 518 selected references to unclassified reports and published literature on the economics of nuclear power. Author, report number, and subject indexes are given. (auth)

23761 TID-6314
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN.

CORE I, SEED 2. SECTION 3. Test Results. First issue, May 25, 1960. Second issue, June 22, 1960. (DLCS-1840305 and DLCS-1840306). OTS.

Tests were made to determine the decrease in radiation level of the Shippingport Pressurized Water Reactor purification system 1AC hairpin loop after isolation, while the reactor operated at full power. (C.J.G.)

23762 TID-6319
Knolls Atomic Power Lab., Schenectady, N. Y.
STEAM GENERATOR LEVEL CONTROL EQUIPMENT. W. H. Bergman. June 9, 1958. 49p. D1G Project. (KAPL-Spec.-KPE-3045). OTS.

A specification relating to the requirements for design, manufacture, assembly, and testing of an electrical three-element feedwater control system for use on naval nuclear power plants is presented. (J.R.D.)

23763 TID-6320
General Atomic Div., General Dynamics Corp., San Diego, Calif.
BASIC HEAT TRANSFER FORMULAS AND CORRELATIONS USED FOR THE HTGR HEAT TRANSFER CALCULATIONS. M. Troost. June 1, 1960. 6p. Project No. 32. Contract AT(04-3)-314. (GAMD-682(Rev.)). OTS.

The heat-transfer calculations are performed by studying a number of coolant channels at different radii simultaneously and interpolating linearly between channels. Two programs were written: one assumes channel crossflow, and the other assumes no crossflow. Helium properties are included as a parameter in formula derivation. Heat-transfer and friction-factor correlations are included. (J.R.D.)

23764 TID-8518(Bk.4)
Atomic Energy Commission, Washington, D. C.
CIVILIAN POWER REACTOR PROGRAM. PART III. BOOK 4. STATUS REPORT ON HEAVY WATER MODERATED REACTORS AS OF 1959. 1960. 57p. GPO.

Estimates indicate that, within the D_2O-moderated natural-uranium-fuel reactor category, the lowest cost reactor will be cooled by boiling D_2O. The margin over nonboiling is small, especially for reactors in the 100-Mw(e) size and smaller. A major area in which research must be advanced before any of the reactor concepts can be successful is fuel-element fabrication and irradiation behavior. Both oxide and metallic elements have their own advantages, and each type should be developed. Other areas in which additional work must be done are the reactivities of various fuel lattices, fuel element burnout (especially for the boiling regime), zirconium pressure tubes and their connections to steel, and methods of reducing and detecting D_2O leakage. (auth)

23765 WCAP-1568
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
AN ANALYTICAL APPROACH TO THE NON-CONDENSABLE GAS PROBLEM IN THERMAL CIRCULATION REACTORS. G. R. Taylor. May 13, 1960. 25p.

The non-condensable gas problem in a thermal circulation reactor is analyzed, assuming steady-state conditions. The results are expressed as bubble size and composition, void fraction, and dissolved gas concentration as a function of distance along a heat exchanger tube. In order to obtain approximate numerical results, several simplifying assumptions are made in the computations. However, the basic expressions are suitable for accurate computations, permitting variations of such parameters as net steam quality, radiolytic gas generation rate, radiolytic gas recombination rate, temperature, pressure, slip velocity, and gas dissolution rate. No computations of fluid head and two phase flow friction factors were undertaken; however, the results have obvious application to this problem. In general, the numerical results indicate a high probability for the successful operation of the TCR with respect to the non-condensable gas problem. (auth)

23766 JPRS-3590
SIMPLIFIED METHOD OF THERMAL CALCULATION FOR A REACTOR USING PRESSURIZED WATER. L. N. Muchnik. Translated from Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 12, 105-9(1959). 8p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 7138.

23767
COMPARISON OF D_2O- AND CO_2-COOLED HEAVY WATER REACTOR. PART II. H. N. Schludi and H. Plank. Atompraxis 6, 164-7(1960) Apr.-May. (In German)

Two 100-Mw reactors were investigated and compared with each other. Both reactors use heavy water as moderator and natural uranium dioxide as reactor fuel. The coolant of one of the two reactors is D_2O, and the fuel cladding used is Zircaloy-2. Coolant outlet temperature is 290°C, and coolant pressure was chosen to be 100 atm. The coolant of the other reactor is CO_2, and the fuel cladding used is beryllium. The coolant outlet temperature of the CO_2 coolant is 550°C, and the coolant pressure of the hot gas was chosen to be 75 atm. The investigation showed the advantages of the gas coolant compared with water coolant. The advantages of the gas coolant are primarily due to the better thermal efficiency that can be achieved with gas coolant. (auth)

23768
SAFETY CONSIDERATIONS FOR THE ORGANIC MODERATED REACTOR IN PIQUA, OHIO. O. Knecht (Internationale Atomreaktorbau GmbH, Bensberg, Ger.). Atompraxis 6, 255-60(1960). (In German)

After a short description of the Piqua reactor; the typical safety features of organic reactors are explained. Methods used to examine frequently discussed reactor accidents are treated in connection with the Piqua reactor. (auth)

23769
SAFETY PROBLEMS OF NUCLEAR PLANTS—CONTAINMENT IN ROCK CHAMBERS. T. Leardini and M. Cadeddu (Società Adriatica di Elettricità, Venice). Energia nucleare (Milan) 7, 517-25(1960) Aug. (In Italian)

Particular problems arising from the design of pressurized water reactors to be located in rock were studied. The Nuclear Department of Società Adriatica di Elettricità in Venice, Italy carried out experimental work on medium size caverns blasted in the Dolomite mountain district of the Veneto in Northern Italy. Two main types of tests were made. These were pumping air into a cavern in order to determine the tightness of different types of wall linings and filling the cavern with air-vapor mixtures at temperatures up to 130°C in order to simulate major-loss-of-coolant reactor accidents. The results of tests carried out in relation to the former were reported. (auth)

23770
A 30-MW ADVANCED GAS-COOLED REACTOR INSTALLATION. M. Lindfield. G. E. C. Atomic Energy Rev. 2, 129-37(1960).

A description is given of the preliminary design of a 30-Mw electricity generating station of the gas-cooled reactor type. The design calls for 2.16 % enriched uranium dioxide fuel contained by stainless steel, a graphite moderator, a carbon dioxide coolant, and average burn-up of 10,000

Mwd/tonne uranium. Longitudinal and transverse cross sections through the reactor and reactor hall are given showing the arrangements for fuel handling, core, and biological shield. An analysis of the generating costs results shows a total cost of 1.39 pence/kwh. (B.O.G.)

23771

THE DESIGN AND CONSTRUCTION OF THE BIOLOGICAL SHIELD AT HUNTERSTON (PART II). S. Gill. G. E. C. Atomic Energy Rev. 2, 150-60(1960).

The biological shield which was installed at Hunterston is described. The permissible limits of design are based on a maximum stress of 27,000 psi. A section through the shield shows calculated temperatures (°F) for an external ambient temperature of 30°F. The variation of compression and tension stresses with height are given for the main part of the shield. The design of this shield was derived from knowledge gained in the construction and operation of the Calder Hall station. Future aspects of the design of biological shields are discussed. (B.O.G.)

23772

DIRECT CONVERSION OF NUCLEAR HEAT TO ELECTRICITY. W. E. Shoupp (Westinghouse Electric Corp., Pittsburgh). Metal Progr. 78, 108-11(1960) Sept.

The possibilities of the nuclear reactor as a high-temperature heat source were investigated. A fuel element of UO_2 pellets in a tube of stainless steel or zirconium was considered. The thermoelectric principle could be used to convert the heat of fission directly into electrical energy. The most efficient way found to do this was to expose the hot junction of the thermoelectric device to a hot fuel element in a nuclear reactor and the cold junction to the moderator-coolant water. To overcome the undesirable effect of radiation on thermoelectric materials, an indirect method could be used with the moderator-coolant water used as the heat source. This method would require a boiler which used thermoelectric tubes instead of regular boiler tubes. The direct method appeared to be superior for thermoelectric generators above 10 kev. (M.C.G.)

23773

THE AGESTA NUCLEAR POWER/HEAT PROJECT. SWEDEN'S FIRST INDUSTRIAL REACTOR. Nuclear Energy, 358-60(1960) Aug.

The design characteristics of Sweden's first industrial reactor installation are discussed. The reactor is of the pressurized type with heavy water as moderator, reflector, and coolant. The fuel is Zircaloy-2 canned uranium oxide pellets. The design is for 65 Mw(t) output initially, of which 10 Mw will be used to operate a back pressure turbine. The remaining 55 Mw is to be used in a district heating scheme serving 10,000 homes in a Stockholm suburb. An outline is given of the conditions which actuate a reactor shut down. The reactor, coolant, and auxiliary circuits, together with the station control room, are located in an underground chamber excavated in rock. The turbine house and water purification plant are above ground level. The excavation, called the reactor hall, is 55-ft wide, 187-ft long, and a maximum height of 140 ft. The minimum thickness of rock covering the hall is 45 ft. The hall walls are lined with steel plate to afford further protection against leakage of radioactivity. (B.O.G.)

23774

PRESSURE VESSEL FOR THE A.G.R. Nuclear Energy, 363-4(1960) Aug.

A description is given of the AGR pressure vessel. It measures 21 ft 3 in. mean diameter by 53 ft 6 in. length over its hemispherical ends. The working pressure for the system is 300 psi compared to the 100 psi of the larger Calder vessel. The thickness of the end plates was $1\frac{3}{4}$ to $3\frac{7}{8}$ in. The vessel was supported at twelve points to ensure no vertical motion of the ducts. Hydraulic tests were conducted as soon as it was feasible for the reactor to carry a head of water. (B.O.G.)

23775

CONTROL OF POWER REACTORS. [PART] 2. R. H. Campbell (United Kingdom Atomic Energy Authority, Risley, Eng.). Nuclear Power 5, No. 52, 74-7(1960) Aug.

The over-all control and performance required of an automatic control system for power reactors are considered. Diagrams are included showing Xe^{135} concentration following start-up and shutdown, effects of rod insertions on flux shapes, system with controls on flux and on temperature, and schematics of the control loop and the over-all control system. The automatic controller design includes systems for automatic start-up and for spurious trip control. Station control may be achieved by controlling the coolant blowers directly from a quantity which is dependent on the demanded load, such as the steam pressure at the turbine. (B.O.G.)

23776

NUCLEAR MERCHANT SHIP SURVEY. J. Spencer Burkett. Nuclear Power 5, No. 52, 78-82(1960) Aug.

A country by country survey is included of progress, economic studies, and designs of marine reactors. The studies include reactors of the types PWR, BWR, OMR, GCR, and HTGCR. Ship reactor design is well advanced. The main consideration is reactor safety. 41 references are included. (B.O.G.)

23777

Franklin Inst., Philadelphia and American Nuclear Society. Delaware Valley Section.

GAS COOLED REACTORS. Proceedings of the Symposium, February 10 and 11, 1960, Philadelphia. Philadelphia, Journal of the Franklin Institute, 1960. Monograph No. 7. 354p. $5.00.

Twenty-three papers are included; separate abstracts have been prepared for 22. The remaining paper had been previously abstracted in Nuclear Science Abstracts. (M.C.G.)

23778

GAS-COOLED REACTORS, A SUMMARY. Robert A. Charpie and Alfred M. Perry (Oak Ridge National Lab., Tenn.). p.3-26 of "Gas-Cooled Reactors."

Considerations relating to gas-cooled reactors of various types and of differing degrees of technical development were discussed. Current technical limitations were reviewed in terms of their impact on capital and fuel-cycle costs, and examples were taken from current designs of gas-cooled reactors to illustrate these effects. The economic incentive for various technological improvements was discussed. The application of gas-cooled reactors to the problem of breeding with the $Th-U^{233}$ fuel cycle was reviewed. (auth)

23779

THE HTGR, AN ADVANCED, HIGH-TEMPERATURE, GAS-COOLED, GRAPHITE-MODERATED REACTOR. Corwin L. Rickard (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.27-42 of "Gas-Cooled Reactors."

The high-temperature, gas-cooled, graphite-moderated reactor (HTGR), which is intended for economic production of power in central power stations, is being developed. The idea basic to development of this reactor concept is an attempt to combine the high power density usually associated with liquid-cooled reactors and the high-temperature capability of gas-cooled reactors while simultaneously achieving a high burnup of the fuel per core loading. High-temperature operation, good neutron economy, and high fuel burnup are possible because graphite is used not only as the moderator but also as the core structural material, fuel diluent, and fuel-cladding material. High-power density and high over-all plant thermal efficiency (35 to 40%) result from the high core temperatures that are permissible. A 40Mw(e) prototype HTGR plant, to be owned and operated by the Philadelphia Electric Company, is scheduled for completion by the end of 1963. The prototype plant will be helium cooled. When it is operated with graphite-clad fuel elements, it will produce 1450-psia, 1000°F steam. The net plant thermal efficiency will be approximately 35%. Currently, work is being done on fuel-element and materials development, in-pile and out-of-pile testing, development of an in-pile high-temperature loop, heat-transfer coefficient measurements, theoretical and experimental neutron-thermalization studies, core nuclear design and control-rod studies, fuel-handling equipment design, and control-rod and rod-drive design. Although development of plant equipment does not require as extensive a program as development of the reactor, current work includes design studies of steam generators, canned-motor helium circulators, concentric ducts, and valves and both design studies and experimental work on equipment for helium purification and fission-product trapping. (auth)

23780

THE ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. G. A. Newby (Aerojet-General Nucleonics, San Ramon, Calif.). p.43-51 of "Gas-Cooled Reactors."

A mobile nuclear power package was developed in the 500 Kw electrical output power range. This unit, known as ML-1 in Army nomenclature, is expected to be near prototype of a unit which will fulfill a military requirement for a power source whose basic system requirements are portability, reliability, safety, and simplicity of operation. Two of the experimental installations connected with the project began operation and they are expected to produce necessary operating and development data which will be used in the design of the ML-1 power package. The system is a nitrogen-cooled, water-moderated reactor operating on the Brayton cycle; it is expected to be one of the most advanced compact nuclear power plants. (auth)

23781

MARITIME GAS-COOLED REACTORS. Harry L. Browne (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.52-66 of "Gas-Cooled Reactors."

The Maritime Gas-cooled Reactor Program combines the gas-cooled high-temperature reactor with the closed-cycle gas-turbine system. This combination permits the utilization of the best features of these two major components. The result promises to be the achievement of a thermodynamic cycle of substantially higher efficiency than that advanced by any competitive fossil-fueled or nuclear-fueled power plant for maritime application. Specific comparisons between the MGCR concept and other nuclear systems can be made. The economic superiority of the MGCR system over other nuclear power plants for the maritime application seems promising. (auth)

23782

THE EXPERIMENTAL GAS-COOLED REACTOR DESIGN. M. Bender (Oak Ridge National Lab., Tenn.). p.67-80 of "Gas-Cooled Reactors."

The Experimental Gas-cooled Reactor located on the Clinch River at Oak Ridge, Tenn., was specified by the AEC as a dual-purpose reactor to demonstrate the production of electrical power from a gas-cooled nuclear power station and also to provide experimental facilities to support the gas-cooled reactor program in the United States. Important features of this plant, which is scheduled to be in operation by the end of 1962 are described. (auth)

23783

THE AUSTRALIAN HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH PROGRAM. Ian J. W. Bisset (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.81-6 of "Gas-Cooled Reactors."

Research facilities and a high-flux research and materials testing reactor were developed at Lucas Heights. The high-temperature, gas-cooled (HTGC) reactor research program was established to develop a reactor that would produce 1 Mw per kg of fissionable material with a burnup of 100% and an internal conversion factor of 1. The increased demand in Australia for electrical power brought about increased interest in the HTGC reactor program. (M.C.G.)

23784

THE PEBBLE BED REACTOR. S. T. Robinson (Sanderson & Porter, New York). p.87-108 of "Gas-Cooled Reactors."

A high temperature gas cycle reactor, fueled with spherical uranium-graphite elements was described. The system, its potential, and the problems of development were discussed. (auth)

23785

THE DEVELOPMENT OF HIGH-TEMPERATURE REACTORS. R. Schulten (Brown Boveri-Krupp, Mannheim, Ger.). p.109-26 of "Gas-Cooled Reactors."

The BBC-Krupp reactor was designed and developed as a high-temperature reactor for the generation of energy. The power station to be erected on this principle will be a test plant to gather experience for large installations. (auth)

23786

THE DRAGON PROJECT. C. A. Rennie (Atomic Energy Establishment, Winfrith, Eng.). p.136-7 of "Gas-Cooled Reactors."

The Dragon Project was developed to cover a program of research and development work on high-temperature, gas-cooled reactors. The reactor experiment, very similar to the HTGR but not designed to generate electricity, was described briefly. (M.C.G.)

23787

FUEL ELEMENTS FOR GAS-COOLED REACTORS. G. Samuels (Oak Ridge National Lab., Tenn.). p.138-49 of "Gas-Cooled Reactors."

Some of the many factors which influence the selection and design of a fuel element were presented. Two of these items, the thermal stability of fuel element clusters and the fuel element life, were discussed in some detail. Also included was a brief description of the experimental program to study the heat transfer and fluid-flow characteristics of rod clusters. (auth)

23788

MATERIALS DEVELOPMENT PROGRAM FOR THE GAS-COOLED REACTOR PROJECT AT THE OAK RIDGE NATIONAL LABORATORY. W. D. Manly and J. H. Coobs (Oak Ridge National Lab., Tenn.). p.150-70 of "Gas-Cooled Reactors."

The materials research and development program for the Gas-cooled Reactor Project at ORNL is divided into two phases: the work done in support of the Experimental Gas-cooled Reactor (EGCR) and the study of materials for advanced gas cooled reactors. Fuel materials, cladding materials, manufacturing methods, and auxiliary components were studied. Slightly enriched UO_2 canned in stainless steel was selected as the fuel element. Graphite was selected as the moderator, and helium was selected as the coolant. A simplified fabrication process for the fuel elements was studied. An extensive irradiation of the fuel elements was initiated to determine fission-gas release, stability, changes in physical properties, effects of thermal cycling, and general over-all integrity. In order to study manufacturing methods a design of the fuel assembly was prepared, using an assumed value of 50% fission-gas release from the UO_2. A number of fuel-element materials with properties favorable for use in advanced designs were studied and an estimate made of their maximum operating conditions. (M.C.G.)

23789
TEMPERATURE OPTIMIZATION OF THE GCRE-I FUEL ELEMENT. W. J. Houghton (Aerojet-General Nucleonics, San Ramon, Calif.), P. M. Williams, and S. T. Perkins. p.190-99 of "Gas-Cooled Reactors."

Fuel elements for the first core of the Gas-Cooled Reactor Experiment consist of four concentric fueled cylinders. Each cylinder is made from three stainless steel plates containing dispersions of UO_2 particles. Neutrons diffuse into the element from the water moderator outside the element. The gas coolant flows axially in the annuli between cylinders. These annular gaps are chosen to yield equal maximum temperatures in all four fuel cylinders of an element. An IBM-650 computer code was written to evaluate temperatures; the calculational results were used as the basis for selecting appropriately sized gaps on a complete element. Comparison with in-pile test results shows good agreement. (auth)

23790
THE UNITED KINGDOM PROGRAM. William Cook (United Kingdom Atomic Energy Authority, Risley, Eng.). p.227-35 of "Gas-Cooled Reactors."

The possibilities of a nuclear power program based initially on natural uranium reactors was explored in the United Kingdom. The goal for this program was set as the installation by 1966 of nuclear power plants able to generate 5 million kw of electricity. An experimental, advanced, gas-cooled reactor was developed, and construction was started. A plan for the utilization in fast-breeder reactors of plutonium produced in the natural uranium reactors was explored. These programs and the participation of the United Kingdom in the Dragon Project were discussed. (M.C.G.)

23791
Edison Electric Inst., New York.
A REPORT ON USSR ELECTRIC POWER DEVELOPMENTS, 1958–1959. 1960. 95p.

Electric power developments in the Soviet Union through 1958 were reported. At the end of 1958 the USSR reported a capability of 53 million kw with thermal stations accounting for 78.8% of the total power production and hydroelectric plants producing the remaining 21.2%. The atomic power program is still in the research and development stage. The USSR is experimenting with many types of reactors in an attempt to make economical power from atomic fuels. In 1958 two nuclear power plants were operating. Transmission of electricity, fuel use and resonances, station costs, electric rates, and employee status were studied. Descriptions of the facilities visited included thermal stations, hydro stations, distribution systems, nuclear development stations, manufacturing plants, and research facilities. The Ohnisk nuclear power plant, which began operation in 1954, is a pressurized water, graphite-moderated reactor, which is capable of producing 30 Mw. A 5 Mw thermal, sodium-cooled experimental fast reactor using PuO as fuel was also placed in operation in 1958. The Beloyarsk plant will have a uranium–graphite reactor which will generate superheated high-pressure steam. The Voronezh station was designed as a two-reactor pressurized water plant, which uses slightly enriched uranium oxide fuel with zirconium cladding. Several tables were included, which gave the historical statistics of electric power in the Soviet Union since 1913. Forecasts were made for electric power development in the US and USSR through 1965. (M.C.G.)

23792
IMPROVEMENTS IN OR RELATING TO GAS-COOLED NUCLEAR REACTORS. Everett Long (to United Kingdom Atomic Energy Authority). British Patent 843,871. Aug. 10, 1960.

A means of emergency shutdown control of a gas-cooled reactor other than gravity-operated rods was devised in which a source of gas is coupled to the coolant inlet. The gas is inert to the materials in the coolant circuit, has a higher neutron absorption cross section than the coolant, and hence will rapidly reduce the reactor reactivity if injected at higher pressure into the coolant. For example, a CO_2-cooled, graphite-moderated reactor can be shut down by the addition of Ar, Xe, or N_2 to the CO_2 coolant. A configuration is presented for a Calder Hall graphite-moderated reactor with 120-psi CO_2 coolant and the above means of control. (D.L.C.)

Production Reactors

23793 AEC-tr-4179
APPARATUS FOR GENERATING A STATIONARY PLASMA. Haruo Tateno. Translated from Japanese Patent No. 6356/58, May 18, 1960. 2p. (Includes original, 1p.). JCL.

An apparatus for generating stationary plasma is presented. A means for striking an arc between two bottom surfaces of a sub-divided cylindrical member and inlets for encircling cooling medium for each sub-division are provided. By adjusting the pressure in the two sections of the cylindrical member, the longitudinal transfer between the sections is reduced to zero, thus establishing stationary plasma conditions. (J.R.D.)

Research Reactors

23794 AD-236712
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE DESIGN OF A BEAM TUBE INSERT FOR THE AIR FORCE NUCLEAR ENGINEERING TEST FACILITY (thesis). Raymond Bennett Walker. Mar. 1960. 70p.

A beam tube insert was designed for use in an eight-inch beam tube in the AFNETR. An environmental control, which provides for altitude simulation between local elevation and 100,000 feet in the test cell of the insert, was included with the design. The design provides a means of performing irradiation testing of airborne components, micro-wave experiment, high vacuum experiments, low temperature experiments, and irradiation of circulating organic fluids. A cost analysis of the insert is included. (auth)

23795 BAW-122
Babcock and Wilcox Co. Atomic Energy Div., [Lynchburg, Va.] and Weather Bureau, Lynchburg, Va.
LYNCHBURG TEST REACTOR SUMMARY HAZARDS REPORT. G. E. Kulynych, comp. Apr. 1960. 151p. OTS.

With this is bound: Weather Bureau, Lynchburg, Va.

LOCAL CLIMATOLOGICAL DATA WITH COMPARATIVE DATA. 1958.

Descriptions of the Lynchburg Test Reactor site, facilities, heat removal system, auxiliary systems, and experimental capability are given. A reactor accident analysis and an environmental hazards evaluation are contained. (C.J.G.)

23796 TID-7584
Brussels. Centre d'Étude de l'Energie Nucléaire.
SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959. June 1960. 452p. OTS.

Abstracts were prepared for 27 of 31 papers presented at the Symposium on High Flux Materials Testing Reactors held in Brussels, Belgium, on September 21 to 26, 1959. (C.J.G.)

23797 TID-7584(p.1-8)
Division of Reactor Development, AEC.
THE AEC TEST REACTOR PROGRAM. Ira F. Zartman. p.1-8 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The AEC Test Reactor Program is reviewed. Problems encountered in constructing and operating various test reactors are discussed. (C.J.G.)

23798 TID-7584(p.9-24)
Argonne National Lab., Ill.
USES OF HIGH FLUX REACTORS. C. N. Kelber. p.9-24 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Previous application of high-flux reactors for studying multiple order reactions, thermal fission cross section of isotopes, radiation chemistry experiments, total cross sections, neutron-diffraction experiments, heat transfer, and fuel element testing is reviewed. (C.J.G.)

23799 TID-7584(p.60-70)
General Electric Company. Atomic Power Equipment Dept., San Jose, Calif.
GENERAL ELECTRIC TEST REACTOR. W. S. Prince. p.60-70 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The design and performance of the General Electric Test Reactor are reviewed. (C.J.G.)

23800 TID-7584(p.71-83)
Nuclear Development Corp. of America, White Plains, N. Y.
SPECIAL DESIGN CONSIDERATIONS FOR HIGH FLEXIBILITY IN BR-2. Stanley Davis, James Duffy, Joseph DeFelice, Arthur Flynn, John Menke, and Dumont Rush. p.71-83 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Design considerations and performance characteristics of the Belgian Reactor-2 are given. (C.J.G.)

23801 TID-7584(p.84-96)
Bureau d'Études Nucléaires, S. A., Brussels.
DIFFICULTIES MET IN THE CONSTRUCTION OF THE BR-2 AND SOLUTIONS ADOPTED. Armand Walravens. p.84-96 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The solutions to various difficulties encountered in the construction of the Belgian Reactor-2 are discussed. The difficulties discussed include: development of inside core equipment, magnitude of residual stresses in steel, fabrication of the central collar of the reactor tank, and waste disposal. (C.J.G.)

23802 TID-7584(p.97-116)
Bureau d'Études Nucléaires, S. A., Brussels and Centre d'Études Nucléaires, Brussels.
ANALYSIS OF THE METHODS OF MEASURING THE SHIELDING EFFECT OF THE RADIATIONPROOF SHELL OF A BR-3 NUCLEAR REACTOR. F. R. Belot, M. Melice, and F. Braibant. p.97-116 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

23803 TID-7584(p.117-25)
Cockerill-Ougrée, S. A., Brussels.
TESTS FOR THE RADIATIONPROOF METALLIC SHELL OF THE BR-2 REACTOR. G. Herzet, G. Martelee, and P. Laval. p.117-25 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The results of tests on the reactor containment shell of the Belgian Reactor-2 to determine pressure resistance, the absence of dangerous stresses, stability of welds, and the accuracy of the method for detecting leaks are presented. (C.J.G.)

23804 TID-7584(p.126-33)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
OPERATIONAL SAFETY CONSIDERATIONS FOR HIGH FLUX TESTING REACTORS. F. L. McMillan. p.126-33 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Various areas of potential safety hazards during operation of high-flux testing reactors are discussed. (C.J.G.)

23805 TID-7584(p.134-47)
Brussels. Centre d'Étude de l'Énergie Nucléaire.
SAFETY OF THE BR-2, THE BELGIUM MATERIALS TESTING REACTOR. H. Dopchie and J. Planquart. p.134-47 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The safety features of the Belgian Reactor-2 are discussed relative to the following possible accidents: primary pump failure, Borax-type accident, malfunction of experiments, start-up accident, and an uncontrolled nuclear excursion. (C.J.G.)

23806 TID-7584(p.148-58)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MANAGEMENT ASPECTS OF MTR-ETR OPERATIONS. J. P. Lyon. p.148-58 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Management aspects of MTR-ETR operations are discussed relative to organization structure, procedures, and approvals required for conducting experiments, irradiation pricing policy, and reactor operating costs. (C.J.G.)

23807 TID-7584(p.159-62)
Brussels. Centre d'Étude de l'Énergie Nucléaire.
ORGANIZATION OF THE BR-2 SECTION. F. Leonard. p.159-62 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The management and operation policies and organization structure of the Belgian Reactor-2 are discussed. (C.J.G.)

23808 TID-7584(p.163-93)
France. Commissariat à l'Énergie Atomique, Paris.
SOME SPECIAL PROBLEMS POSED BY THE OPERATION OF LABORATORY PILES. C. Candiotti, H. Mabeix, and R. Uguen. p.163-93 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The operation of research or "laboratory" piles is discussed relative to the following problems: handling of irradiated devices, control of electric circuits, and safety features. Maintenance of the pile is discussed. (C.J.G.)

23809 TID-7584(p.194-202)
France. Commissariat à l'Énergie Atomique, Paris.
FAILURES IN OPERATION OF EL 2 AND EL 3 BETWEEN 1 JANUARY 1957 AND 1 JULY 1959. P. Balligand. p.194-202 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Operational failures of the Saclay Reactors (EL-2) and (EL-3) for the period January 1, 1957, to July 1, 1959, are reported. The most frequent failures in the EL-2 Reactor were due to jacket fractures. An accident resulting in the removal of a fuel cell from the EL-3 reactor is reported. (C.J.G.)

23810 TID-7584(p.203-05)
Reactor Centrum Nederland, Brussels.
INSTRUMENTATION AND CONTROL OF THE NETHERLANDS MATERIALS TESTING REACTOR. P. C. van den Berg. p.203-05 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The control rod system, nuclear flux instrumentation, automatic control system, and safety and interlocking circuits of the Netherlands Materials Testing Reactor are described. A diagram of the control rod system is presented. (C.J.G.)

23811 TID-7584(p.210-19)
Ateliers de Constructions Électriques de Charleroi. Division Nucléaire, Belgium.
CONTROL EQUIPMENT OF THE BR-2 REACTOR AND ITS NUCLEAR MODEL. J. Lhoir. p.210-19 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The control rod system and nuclear instrumentation of the Belgian Reactor-2 are described. (C.J.G.)

23812 TID-7584(p.220-25)
Manufacture Belge de Lampes et de Materiel Electronique, Brussels.
CONTROL EQUIPMENT OF THE BR-2 REACTOR: CONTROL OF RADIATION AND RADIOHYGIENE. C. Brooke and R. Schayes. p.220-25 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Radiation hazards control of the Belgian Reactor-2 is discussed relative to monitoring radioactive fission gases, measurement of slow and fast neutrons, gamma measurements, and alarm systems. (C.J.G.)

23813 TID-7584(p.226-54)
Reactor Centrum Nederland, Brussels.
EXPERIMENTAL FACILITIES OF THE R.C.N. MATERIALS TESTING AND RESEARCH REACTOR. J. J. M. Snepvangers and S. H. Woldringh. p.226-54 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Descriptions and diagrams of the experimental facilities of the RCN (Reactor Centrum Nederland) Materials Testing and Research Reactor (Dutch Materials Testing and Research Reactor) are given. The facilities discussed include in-core through tube, U-tube, holes in Be reflector and Al elements, fuel and reflector element positions, horizontal beam-tubes, and large horizontal facility. (C.J.G.)

23814 TID-7584(p.255-78)
Société Belge pour l'Industrie Nucléaire, Brussels.
CONTRIBUTION TO THE IMPROVEMENT OF PNEUMATIC SYSTEMS FOR THE TRANSPORT OF SAMPLES IRRADIATED IN NUCLEAR REACTORS. C. Dehon, J. Chermanne, and E. Fossoul. p.255-78 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The design, operation, and in-reactor performance of a pneumatic system which transports samples into or within a reactor core are discussed. The effects of a sample, both radioactive and non-radioactive, on the dynamic behavior of a reactor are discussed. (C.J.G.)

23815 TID-7584(p.279-301)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DESIGN OF LOOPS FOR HIGH FLUX REACTORS. D. C. Kaulitz. p.279-301 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The operation and performance of both single pass and recirculating low- and high-pressure loop systems in high-flux reactors are discussed. Operation experiences of the testing facilities in the MTR and ETR are discussed. Diagrams of the loops are given. (C.J.G.)

23816 TID-7584(p.302-23)
France. Commissariat à l'Énergie Atomique, Paris.
USE OF IRRADIATION ZONES IN THE FUEL ELEMENT LATTICE OF RESEARCH PILES. P. Delattre and J. P. Genthon. p.302-23 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The possible irradiation regions in a fuel element lattice (for the case of the Saclay Reactor (EL-3)) are enumerated. The advantages and disadvantages of different types of channels are discussed. The optimum channels in which to conduct experiments with fast neutrons, thermal neutrons, and gamma rays are described. (C.J.G.)

23817 TID-7584(p.324-39)
France. Commissariat à l'Énergie Atomique, Paris.
FAST NEUTRON DOSIMETRY IN RESEARCH REACTORS. R. Eckert. p.324-39 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Fast neutron dosimetry methods using threshold detectors and based on a calculated spectrum are presented. It is shown how to calculate first the neutron spectrum and subsequently the average effective cross section $\bar{\Sigma}$. It is shown how to determine experimentally the neutron spectrum by means of threshold and resonating detectors. (C.J.G.)

23818 TID-7584(p.340-45)
France. Commissariat à l'Énergie Atomique, Paris.
DISTRIBUTION OF THE FLUX OF THERMAL NEUTRONS IN URANIUM SAMPLES IRRADIATED IN A LOOP COOLED BY DOWTHERM. R. Besse and J. Ratier. p.340-45 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

A method for the determination of the thermal neutron flux distribution to which a uranium sample is subjected in a loop cooled by Dowtherm (mixture of diphenyl and diphenyl oxide) is presented. (C.J.G.)

23819 TID-7584(p.346-66)
Brussels. Centre d'Étude de l'Énergie Nucléaire.
MEASUREMENT OF THE NUCLEAR CHARACTERISTICS OF EXPERIMENTS. F. Motte. p.346-66 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

An analysis of the nuclear characteristics of experiments introduced into a reactor is made. The effects which the presence of the experiment has on the behavior of the reactor are discussed. The need to know accurately the nuclear characteristics of the experimental chamber is discussed. Techniques of dosimetry for detecting thermal, epithermal, and fast neutrons and gamma rays are reviewed. (C.J.G.)

23820 TID-7584(p.367-73)
Cockerill-Ougrée, S. A., Brussels.
SIGNIFICANCE OF AN EXPERIMENTAL MEASUREMENT OF THE ACTIVATION OF DIFFERENT TYPES OF STEEL FOR REACTOR TANKS. Pierre Maldague. p.367-73 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

An analysis was made of the stable isotopes present in steel which by absorption of slow neutrons transform into radioactive isotopes. The results indicate that lowering the cobalt content of steels for nuclear reactors (0.1% in stainless steels and 0.01% in low alloy steels) does not appear useful due to other isotopes present which transform into radioisotopes having long half lives. These isotopes and resulting reactions are $Ni^{60}(n,p)Co^{60}$, $Fe^{54}(n,\gamma)Fe^{55}$, and $Ni^{58}(n,\gamma)Ni^{59}$. (C.J.G.)

23821 TID-7584(p.374-82)
Philips' Gloeilampenfabrieken, N. V., Eindhoven, Netherlands.
SAFETY PRINCIPLES IN THE INSTRUMENTATION OF REACTORS. F. J. Schijff. p.374-82 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Safety principles in the instrumentation of reactors are discussed relative to site, construction, and operation. (C.J.G.)

23822 TID-7584(p.383-93)
Ateliers de Constructions Électriques de Charleroi. Division Nucléaire, Belgium.
TECHNOLOGICAL ASPECTS OF CONSTRUCTION OF THE BR-2 REACTOR TANK. Boutique, Givront, and Gobain. p.383-93 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

The construction of the Belgian Reactor-2 tank is described, and diagrams of various phases of the construction are presented. (C.J.G.)

23823 TID-7584(p.394-447)
Oak Ridge National Lab., Tenn.
OPERATING EXPERIENCE WITH IN-PILE LOOPS AT ORNL. J. A. Cox. p.394-447 of SYMPOSIUM ON HIGH FLUX MATERIALS TESTING REACTORS, HELD IN BRUSSELS, BELGIUM, SEPTEMBER 21-26, 1959.

Operating experience obtained at ORNL with in-pile loops cooled with water, gas, single-pass air, sodium, and helium and with fuel loops of aqueous uranyl sulfate and molten salt is summarized. Various failures are discussed. A safety hazards and safeguards analysis was made. Instrument reliability, operating standards, and safety instrumentation for experiments are discussed. Operation and performance of the various loops are discussed. (C.J.G.)

23824
JASON. B. D. Baines (Hawker Siddeley Nuclear Power Co., Ltd., Langley, Eng.). Atompraxis 6, 266-70(1960). (In English)

The development of the two types of Jason reactor is reported (10-kw Standard Jason, 100-kw Jason). Essential data are given on their construction and operation. The projects which were, or could be, carried out with these reactors are briefly mentioned, with special emphasis on the adaptability of the reactor to various uses. (auth)

23825
THE MINERVE REACTOR. [J.] Yvon and Denis Breton (Center d'Études Nucléaires, [Saclay, France]). Energie nucléaire 2, 144-51(1960) May-June. (In French)

The Minerve Reactor, one of the two swimming pool reactors at Fontenay-aux-Roses, is designed primarily to measure the cross sections of reactor construction materials. A description is given of the reactor vessel, the reactor itself (swimming pool and core), the water circuits, and the control and safety devices. (tr-auth)

23826
THE "CONSORT" REACTOR FOR TRAINING AND RESEARCH. K. Hart and C. G. James. G. E. C. Atomic Energy Rev. 2, 118-28(1960).

A description is given of the design characteristics of the Consort training and research reactor. The design is characterized by compactness and simplicity. This leads to low capital and operating costs. It will combine the principal advantages of the swimming-pool and enclosed-tank types of reactor by providing the accessibility and ease of fuel handling of the former while retaining the compact layout of the latter. The initial design is for a 10-kw thermal output, using standard fuel elements of enriched-uranium alloy, which will be moderated and cooled by ordinary (demineralized) water. A modified design allows the output to be extended to 100-kw. The higher neutron intensities thus obtained will enable radioisotopes of high specific activity to be produced, as well as the experimental facilities to be enhanced. (B.O.G.)

23827
THE ZERO-ENERGY REACTOR "ZENITH." K. J. Mitchell and L. E. J. Witts. G. E. C. Atomic Energy Rev. 2, 138-47(1960).

A description is given of the engineering design aspects and construction procedures of the Zenith. It is a zero-energy experimental unit for the high-temperature gas-cooled reactor type using the uranium-233–thorium cycle. Its purpose is to provide reactor physics data for nearly homogeneous high-temperature gas-cooled systems. The core consists of graphite tubes, rendered impermeable to gas and containing pellets of fissile and fertile materials and graphite. A flow sheet is given showing the nitrogen coolant circuit parameters. (B.O.G.)

23828
BR-3. I. GENERAL DESCRIPTION. L. Mergan (Centre d'Étude de l'Énergie Nucléaire, [Brussels]). Nuclear Eng. 5, 337-41(1960) Aug.

A description is given of Belgium's first power reactor, the first pressurized water reactor in Western Europe. With a thermal rating of 40.9 Mw, its electric output is 10.7 Mw(e). The complete arrangement of the plant is shown on a pull-out illustration. The 12 cruciform control rods of an 80-Ag, 15-In, 5-Cd alloy are fitted with long extensions of Zircaloy-2 which act as guides and fill the space when the rod is withdrawn, thus preventing "water-hole" formation and the consequent flux peaking.

The pressure vessel is carbon steel with stainless-steel cladding. (B.O.G.)

23829

BR-3. II. DESIGN PHILOSOPHY AND PLANT CONSTRUCTION. P. Erkes (Bureau d'Etudes Nucléaires, [S. A., Brussels]) and G. Tavernier. Nuclear Eng. 5, 342-7(1960) Aug.

A study was made of the design philosophy leading to special characteristics of core design, plant control, coolant loop layout, safety injection system, and plant container. Some features of the actual construction are discussed. Work on the site was started in November 1957, and criticality is expected by the end of 1960. A construction schedule is given for work completed through June 1960. (B.O.G.)

23830

BR-3. III. CORE DESIGN AND TESTING. James A. Kilpatrick (Westinghouse Electric Corp., Pittsburgh). Nuclear Eng. 5, 349-52(1960) Aug.

A continuation of a series is given which describes the BR-3. This discussion concerns the developmental problems associated with the core and the metallurgical aspects of the development of fuel elements and control rods. A description is included on the criticality experiments conducted by Westinghouse at their critical test facility. (B.O.G.)

23831

FUEL DAMAGE IN WTR INCIDENT. Nucleonics 18, No. 9, 104(1960) Sept.

Fuel damage occurred during a calibration run on April 3, 1960 in the Westinghouse Testing Reactor. A 500 lb force was needed to pull out the upper $^1/_3$ of the ruptured element. The remaining $^2/_3$ had to be sawed out. Disassembly revealed that the two inner tubes had melted to within 6 in. of their tops, while the outer tube had 11 in. intact. A large amount of molten fuel alloy had run out from between the cladding. Spare fuel elements were reinspected with ultrasonic tests and many poor bonds, cracks, foreign inclusions, and voids were spotted in the fuel. These inspections indicated that fuel specifications were too loose and inspection too lax. (M.C.G.)

WASTE DISPOSAL AND PROCESSING

23832 CF-60-7-17

Oak Ridge National Lab., Tenn.

STUDIES OF THE USE OF COAGULANT AIDS IN THE LIME-SODA TREATMENT OF LARGE-VOLUME, LOW-LEVEL RADIOACTIVE LIQUID WASTE. T. Subbaratnam, K. E. Cowser, and E. G. Struxness. Aug. 22, 1960. 33p. Contract W-7405-eng-26. OTS.

Studies on the use of coagulant aids in the lime-soda treatment of large-volume, low-level radioactive liquid waste revealed that a combination of Hagan Aids No. 50 and No. 18 gave fairly good results under most conditions. The effects of feed solution concentrations, mode and point of addition, and water temperature were studied. (C.J.G.)

23833 HW-61796

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A TEST OF THE REFRACTION SEISMIC METHOD ON THE HANFORD PROJECT. J. R. Raymond and C. A. Ratcliffe. Sept. 25, 1959. 21p. Contract AT(45-1)-1350. OTS.

An investigation was made to test the practicability of seismic geophysical exploration for investigating geologic and hydrologic features affecting ground disposal of liquid radioactive wastes. The theory of the refraction seismic method of geophysical investigation is briefly discussed. The method was tested on the Hanford project by use of a laboratory-built single-channel seismograph. The instrument generally operated adequately, and the tests were successful. The method was tried at two sites: one selected to attempt detection of the ground-water surface and the other to attempt detection of the basalt bedrock surface. At both sites the responding horizon was less than 50 feet below the surface. In both cases the surface of the responding horizon was delineated within accuracy of a few feet. It is concluded that seismic survey with well-developed commercial instruments will provide valuable knowledge of depth to basalt and other geologic horizons. (W.L.H.)

23834 TID-6317

Texas. Univ., Austin. Civil Engineering Research Lab.

REACTOR FUEL WASTE DISPOSAL PROJECT; DEVELOPMENT OF DESIGN PRINCIPLE FOR DISPOSAL OF REACTOR FUEL WASTE INTO UNDERGROUND SALT CAVITIES. Shosei Serata and Earnest F. Gloyna. Jan. 1, 1959. 189p. Contract AT(11-1)-490. OTS.

Waste disposal in underground salt cavities is considered. Theoretical investigations for spherical and cylindrical cavities included analysis of elastic stress, thermal stress, and stress redistribution due to the development of a plastic zone around the cavity. The problems of temperature distribution and accompanying thermal stress, due to heat emission from the waste, were also studied. The reduction of the cavity volume, the development of the plastic zone, and the resulting stress redistribution around the cavity are presented as functions of cavity depth, internal pressure of cavity, strength of salt, and cavity temperature rise. It is shown that a salt cavity can be designed such that it is structurally stable as a storage container assuming a chemical equilibrium can be established between the liquid waste and salt. (W.D.M.)

23835

THE INFLUENCE OF SYNTHETIC DETERGENTS AND COMPLEX-FORMING COMPOUNDS ON THE DECONTAMINATION OF RADIOACTIVE SEWAGE BY MEANS OF THE CHEMICAL PRECIPITATION METHOD. S. Krawczynski (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H, Karlsruhe, Ger.). Atompraxis 6, 320-2(1960). (In German)

Radioactively contaminated sewage, as it is found in practice, can often be decontaminated only poorly, if at all, by chemical precipitation, in contrast to laboratory experiments. A number of detergents and complex-forming compounds were examined in regard to their influence on the decontamination of radioactive sewage. It was found that this method is easily disturbed by the presence of even very slight traces of complex-forming compounds such as tartaric acid, citric acid, EDTA and other chelating agents, while other commercial detergents had no appreciable negative influence on the precipitation method. The results of the laboratory experiments were confirmed by extensive experiments on a pilot-plant scale. (auth)

23836

UTILIZATION OF AN EXPERIMENTAL APPARATUS FOR SOIL DISPOSAL AT C.E.N. OF SACLAY. René Amavis and Jacques Vaccarezza (Center d'Études Nucléaires, [Saclay, France]). Energie nucléaire 2, 166-80(1960) May-June. (In French)

The results of percolation tests of H^3 and Sr^{90} made on the soil at Saclay both in the laboratory and on the ground are presented. Extrapolation, using the parameters introduced by Hiester and Vermeulen and by W. J. Kaufman, appears satisfactory when the soil is homogeneous. (tr-auth)

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